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## SECTION – A

## TECHNICAL SPECIFICATIONS

The specification describes the requirements for the supply and installations of electrical/ low current systems.

### 1. SCOPE OF WORK

The works under these specifications includes providing of all materials & equipments and performing the work necessary for completion of work as shown on the drawings, specified in specification & bill of quantities. The work also include to obtain clearances, certificates etc. from the relevant authorities and also to give the required notices to local electrical authorities and assist the owner in getting electrical connections. The work shall by include but not limited to the following:

#### a) Electrical Works

- |       |                             |               |
|-------|-----------------------------|---------------|
| i.    | Low Voltage Switchgear      | (Section - B) |
| ii.   | Low Voltage Cable and Wires | (Section – C) |
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#### b) Low Current Systems

- |      |                                    |               |
|------|------------------------------------|---------------|
| i.   | Voice & Data Communication Systems | (Section – M) |
| ii.  | Addressable Fire Alarm System      | (Section – N) |
| iii. | Conventional Fire Alarm System     | (Section –O)  |

iv.	CCTV System	(Section – P)
v.	Public Address/Sound System	(Section - Q)
vi.	Nurse Call System	(Section – R)
vii.	Security Access System- Velocity System	(Section – S)

## **2. MATERIALS ORIGIN**

- a) All material and equipment supplied by the Contractor shall be new and shall be in accordance with the details described in BOQ and/or shown on drawings. If the contractor desires to use different materials other than specified, he shall obtain the approval from consultant in writing before using the materials.
- b) The Contractor shall also be responsible to supply any other equipment not mentioned in specifications but which is necessary for completion of works, it shall be provided by the Contractor as part of the Contract.
- c) Material shall be in accordance with high standard specifications. The contractor shall submit the samples of materials with complete specifications etc for the approval of consultants, before ordering or installation of materials. Approval of materials/installations shall not relieve the contractor of any of his obligations or liabilities under the contract. The Consultants/Owners or Representatives reserve the right to inspect the materials in store or in installed at site and to reject any material not complying with specifications without any extra cost.
- d) When choice of manufacturers is allowed for any material/equipment, the contractor shall obtain the whole quantity required to complete the job from one manufacturer otherwise he shall provide evidence to the consultant for non-availability of material/equipment in market.

## **3. RULES, REGULATION AND STANDARDS**

The entire electrical installation / work shall be carried out by licensed electrical contractor, issued by Electric Inspector. The work shall be carried out by qualified & experienced workers having permits/certificates issued by Electric Inspector to undertake such a job. The contractor's license number and supervisors competency certificate shall be submit before commencement of work.

All works shall be carried out in accordance with the latest edition of the Regulations of Electrical Equipment of Buildings issued by the Institute of Electrical Engineers - London, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision shall be final and conclusive.

The Contractor shall be responsible to complete all the formalities/requirements and get the installations passed by the Electric Inspector and submit the test certificates to Owner/Electric Company without any extra cost.

All installations/equipment and materials shall conform to the following standards:

- a) International Electro-technical Commission (IEC)
- b) British Standards (BS)
- c) National Electric Code (NEC)
- d) National Standards
- e) Any other international standards

In the event of conflict between the standards, the most stringent shall prevail.

Whenever any electrical equipment is to be installed, which does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets any one of the above mentioned standards.

#### **4. INSTALLATION AND SERVICE CONDITIONS**

##### **4.1 Site Conditions**

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material / equipment:

- a. Maximum outdoor ambient temperature : 45<sup>0</sup>
- b. Minimum Indoor ambient temperature : 15<sup>0</sup>
- c. Maximum relative humidity : 90 %
- d. Minimum relative humidity : 26 %

##### **4.2 Service Conditions**

- 4.3** Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

#### **5. MAIN ELECTRICAL CHARACTERISTICS**

##### **5.1 Power Supply System**

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any

de-rating:

- Voltage 400V  $\pm$  10%
- Phase 3phase, 4 wires system
- Frequency 50 Hz.  $\pm$ 2 Hz.

### **5.2 Degree of Protection of Enclosures**

For indoors, IP31 minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529.

## **6. GUARANTEE**

- a) The Contractor shall furnish written grantee that the material & installations meet with this specification and the electrical systems are free from all grounds and all defective workmanship and materials and will remain so far a period of one year after handover of project. Any defect appearing within one year, shall be rectified by the contractor at his own cost.
- b) The contractor shall indemnify and save harmless the owner and consultant from and against all liabilities for damages arising from injuries to persons or property occasioned by any act or commission of the worker/sub-contractor/contractor including any or all expenses, legal or otherwise, which may be incurred, any and all expenses, legal or otherwise by the owner in the defense of any claim, action or suit

## **7. SPECIFICATIONS & DRAWINGS AT SITE**

The Contractor shall have for ready access and refer a complete set of drawings/design, BOQ specification at site. He shall incorporate all changes, additions/ alterations made at site during installations and shall prepare a set of drawings indicating the work as actually and finally installed.

## **8. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS**

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall consult with the consultants before starting the work. If such defective or modified work is carried out by the Contractor, he shall rectify the same at his own cost.

## **9. MEASUREMENT OF WORKS**

The quantities set out in the bill of quantities are estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor shall carry out actual measurement of works at site and prepare bill accordingly

## **10. INSTALLATIONS/PROTECTIONS/CO-OPERATION**

- A. The locations, routings, installation heights, and other details etc. for installations are shown on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or consultants.
- B. The contractor shall protect his own work from damage and he shall likewise protect adjoining works of other trades during or after installations.
- C. The contractor shall co-operate and work as a team with all other contractors during the installation.

## **11. DRAWINGS AND WORKMANSHIP**

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data to fit with architectural details as per instructions given to him.

- a. The plans are drawn on the basis of architectural drawings. The plans are diagrammatical and do not necessarily show all details to fit the building conditions. The location of outlets, fittings, fixtures & equipments are approximate and may be accommodate to site conditions.
- b. No major change shall be made without the approval of consultant. The contractor shall examine all approved shop drawings of other trades in detail and he shall frequently consult to ascertain any change that may have been made.
- c. The work shall be executed in the best and most thorough manner under the direction of consultants. The consultants reserved the rights to reject any installation/material, which is not in accordance with the drawings & specifications.

## **12. IDENTIFICATION**

- a. For each of the equipment, identification label shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white back ground of trifoliate and fixed with screws.
- b. All DB's shall be provided with detail circuit sheet fixed inside the front cover indicating the function and circuit numbers. Spare circuit space shall be left blank.
- c. On AC system the phase sequence shall be maintained in the order of Red, Yellow and Blue from top to bottom and/or left to right. Neutral and earthing wires to be connected on respective link or bus-bars.
- d. Where 400 volts or above exists the equipment shall be marked "DANGER 400V" engraved in front of the equipment with the requirements of electricity rules and according to engineering

practice.

### **13. SWITCHGEAR TESTS**

All switchgear installed by the Contractor etc shall be fully tested at the manufacturer's place to meet the requirements of appropriate standards without any extra cost.

The Contractor shall inform the Engineer in writing about the date and time of test at least 3 days in advance. The witnessing of test by the Owner or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment and for furnishing the guarantees. All test results in the form of certificate/record certificates, signed by all the witnesses, shall be submitted to the Engineer 3 days before delivery to the site.

### **14. STORAGE**

The Contractor shall store the equipment in dry warehouse and protect from damages. Fragile components shall be stored on shelves in their original packing, marked with identification labels.

The Contractor shall handle, store and fix each of the equipment as per the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer if required.

### **15. LABOR AND STAFF**

The Contractor shall provide all labor materials, tools and equipments for installation and testing of work as detailed below:

- Skilled and unskilled labor required for performing the works as per specifications and drawings.
- Experienced supervising staff with requisite expertise to ensure quality of work in time.
- Administrative staff to ensure smooths functioning of site activities.
- Construction equipment, measuring tools, apparatus and working tools in good working conditions.

The Contractor shall be responsible for the performance of any sub-contractors, worker and manufacturer at his own cost and risk.

### **16. SMALL INSTALLATION MATERIAL**

The Contractor shall supply and install all small installation and consumable materials such as

nuts, screws, anchor, bits, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, lugs etc, required to complete the job without any extra cost.

## **17. INSTALLATION INSTRUCTIONS - GENERAL**

The Contractor shall set out the works himself as per specifications and drawings and shall properly install the equipment on specified foundation / location as per manufacturer's instructions. Any defective or faulty operation of equipment the Contractor shall change/repair the same at his own cost.

## **18. ASSOCIATED CIVIL WORKS**

The Contractor shall be carried out associated civil works under the direction of the Engineer.

The Contractor shall prepare drawings giving details of all associated civil works without any extra cost.

The following work to be carried out by the Contractor during installations:

- a. The cutting and forming of holes or conduits/pipe fixings in walls, floors, ceilings, partitions, roofs, etc., and bringing back the finish to the position that it was before.
- b. Formation of concrete bases or foundation pads.
- c. Excavation forming for underground services of ducts and courses and then covers it.
- d. Excavation for and lying of cables or pipes etc.
- e. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- f. Sleeves through floors/walls, flush with walls/ceilings or finished floors of a size to accommodate the raceways.

All required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building and he should workout in advance the position of holes channels etc to the civil contractor where it's not possible for cutting or chipping etc.

Cutting, fitting, repairing, patching of plaster and finishing of carpentry work shall be done by skilled workers in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be drilled without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

## **19. TESTING**



Upon completion of installations, the Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of the Contractor. The Contractor shall record all test values and submit the same to the consultants.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections to ensure that the entire installation is sound, complete and safe and will function properly and as intended.

The acceptance shall be made by the Owner.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

### **19.1 Insulation Resistance Test**

Insulation resistance test shall be made on electrical equipment and wiring by using a meager of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be tested before wire connections. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit is less than specified values, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out

procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the readings shall be taken and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

### **19.2 Earth Resistance Test**

Earth resistance tests shall be made by contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

### **19.3 Phase sequence test**

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for correct rotation of all motors and entire installation before final connection to supply line.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Name plates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

### **19.4 Low Current Systems Tests**

The testing of Low Current systems shall be carried out as per procedures or recommended by the manufacturer/supplier.

### **19.5 Complete Tests**

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment

so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

## **20. ELECTRICAL CONNECTION**

Electrical connection shall be provided by Electric Supply Company but necessary but necessary arrangement coordination to be done by the Contractor. The temporary arrangements (including materials and labor) for installation/testing purpose to be made by the contractor without any extra cost.

## **21. DRAWINGS, SAMPLES AND MANUALS**

1. The contractor shall prepare shop drawings showing all routes, switches, sockets, DBs and junction/pull boxes locations etc. and submit to the consultant for approval before starting the work without any extra cost.
  - a. Single line diagram indicating all cables, with sizes and types, and rating of circuit breakers, fuses, etc.
  - b. Lighting, power, telephone, fire alarm, nurse call, public address, CCTV, queue management and data/voice systems, as applicable.
  - c. Control and Data/Voice wiring diagrams for the equipments installed by the Electrical Contractor
2. All changes/additions/alterations shall be carefully recorded during the work and the Contractor shall prepare as built drawings. On approval of drawings the Contractor shall provide two set of drawings to the consultant and owner before final payments.

The Contractor shall submit for approval of the manufacturer's instructions for installation, testing, commissioning, operation and maintenance manuals of the equipment before installation. Upon acceptance, the Contractor shall supply a copy to the Owner. The contractor shall also submit for approval the samples of materials to be used in the project, before starting the installations and approved list of materials/equipments to be handed over to owner.

## **22. WORK COMPLETION**

The Contractor shall further repair/replace all defective works on completion and leave all installations in perfect working order up to the satisfaction of the Owner and consultant. The contractor shall meet all the requirements/instructions given in specifications.

The contractor shall complete each and every work as described and included in these specifications and BOQ as per owner's/consultant's instructions.

### **23. PAYMENT**

Running payments shall be made to the contractors at an interval not less than 15 days at a time. Contractors shall submit running bills to the consultant for verification. After due verification, the owner shall paid the bills to the contractor after deducting applicable taxes.

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## **SECTION - B**

### **LOW VOLTAGE SWITCHGEAR**

#### **1. GENERAL**

##### **1.1 Purpose**

This section describes the minimum requirement for the design, construction and performance of factory assembled LV switchboard.

##### **1.2 Scope of Work**

The job consists of supply, installation, testing, connecting and commissioning of switchboards as specified in BOQ or shown on the Drawings.

##### **1.3 Installation**

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency.

#### **2. MAIN ELECTRICAL CHARACTERISTICS**

##### **2.1 Power Supply System**

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 400 V  $\pm$  10%
- Phase 3 phase, 4 Wires.
- Frequency 50 Hz.  $\pm$  2 Hz.
- Neutral system firmly grounded.

Main characteristics of auxiliary supply system are:

- Control / Command system 24 VDC.
- Space heater system 230 VAC.

##### **2.2 Ratings**

The equipment shall be capable of carrying the specified current continuously 24 hours per day, without exceeding the permitted temperature.

The current ratings must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

Pins of auxiliary circuits shall be sized for a rated circuit of minimum 10 Amp.

### **3. ENCLOSURES**

The Switchboard shall be prefabricated metal clad cubicle(s), floor standing type, totally enclosed, dust tight and vermin proof and front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42.

- a) The short service breaking capacity, ICs at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- b) To provide with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- c) All components shall be rated for insulation class 600-volt minimum.
- d) It shall be designed for flush mounting of all instruments on the front side only.
- e) All incoming or outgoing connections from top or bottom shall be completed. The components mounted so as to facilitate ease of maintenance from the front. Common lamp test facility for all lamps.
- f) The wiring diagram on the inside of door. Be labeled with name plate on the front side of door.
- g) To provide 25% space for extension in future.

#### **3.1 Cable Accessibility**

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

#### **3.2 Heaters**

Space heaters shall be provided for prevention of moisture in each cubicle. Heaters shall be wired together and shall be automatically controlled to avoid over heating the equipment. Heater shall be suitable for operation on 230 VAC supply from an external source (to be provide in main Distribution Board)

### **3.3 Name plates**

On the front side, a name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white background, to be made from trifoliate and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

## **4. CONSTRUCTION**

### **4.1** The switchboard shall be fabricated, welded; grinded, finished with angle iron frame work and clad with 2MM MS sheet, to form a rigid, free standing, flush mounting fronted assembly.

It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories. Each compartment shall be fully partitioned from its neighbor both horizontally and vertically, allowing safe cable routing / termination without shutting the switchboard down.

All live parts within cubicles, compartments or modules, which have to be accessible during normal maintenance operations, shall be adequately protected and / or buried to ensure protection of works and to avoid accidental contact. Barriers may be rigid, transparent, insulating material fitted with warning labels.

The doors shall be provided with hinges on the left-hand side and locking handles on the right hand side for fastening the door. The front assembly shall be fastened to the enclosure by means of self locating fasteners for quick and easy fixing.

All holes, cutouts shall be tool or jib manufactured and free from burrs and rough edges. All structural components shall be of standardized design to provide complete uniformity and interchangeability of common parts. Removable gland plate shall be provided at top and / or bottom as required.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable clamps respectively for PVL/PVC and SWA cables shall be provided.

The cabling inside the Switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the switchboard shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

#### **4.2 Bus Bars**

Bus bars and droppers supported on non - hygroscopic material are to be high conductivity electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified short circuit currents for one second duration.

Bus bars and droppers shall be housed in a separate compartment and shall be clearly marked with Red, Yellow and Blue colors. Bus bars shall be provided for three phases, neutral and multi - terminal earth. The temperature rise shall not exceed 50 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB.

Removable metal covers on the bus bar chamber shall be provided with suitably sized labels at regular intervals, fixed with self tapping screws and warning of live metal work.

All bus bars connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

#### **4.3 Earthing**

A copper earth bar of suitable section for the specified fault level shall extend the entire length of the Switchboard. Provisions shall be made for possible future extensions at both ends.

Earthing facilities shall be provided on each incoming and outgoing unit to permit earthing of the connections.

All metallic non-current carrying parts of the Switchboard shall be bonded together and



connected to the Switchboard's earth bar.

Each circuit wiring shall be green / yellow color. Earthing mass continuity between withdraw able parts and fixed frame shall be correctly ensured whatever withdraw able part position.

Provision shall be made adjacent to cable termination for earthing cable armor to the earth bus bar.

Earthing switch shall be provided wherever mandatory as per rules and regulations / codes and standards and shall be manually operated. An interlocking system shall provide the following locking and safety functions:

- Impossibility of closing the earth switch if the switching device is closed.
- Visual check of earthing switch positions to be possible.
- Possibility of locking the earthing switch operating handle in open and closed position.
- The earthing of the bus bar shall be done manually by the operator without provision of general earthing system.

## **5. DISTRIBUTION BOARDS**

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 1.6mm sheet steel recess or surface mounting. All components shall be installed on a component mounting plate inside the enclosure and protected from the front with screwed sheet steel safety plate. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box of same material & finish shall be provided for accommodating the cables and conduits.

An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB.

All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at top/bottom, as required.

The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC pipe. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of components etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

## **6. COMPONENTS**

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and electrical system. Typical specifications are given here under:

### **6.1 Circuit Breakers**

The circuit breakers shall be panel mounted, compact modular design, trip shall be standard and shall have built in overload and short circuit protection. The breakers shall have high performance, multifunctional type under modern design concept. The breakers should confirm international standards.

The breakers shall have inverse time limit characteristic, instantaneous magnetic trip element for short circuit and thermal overload protection.

#### **a) Molded Case Circuit Breakers (MCCB)**

The MCCB shall be three pole 400 / 500 volts rating. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCB's shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be clearly marked to facilitate connection and maintenance.

The breakers shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' color indication and intermediate 'Tripped' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

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

The MCB's with current rating from 1 to 125 Amps shall be conforming to BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalised.

The MCB's shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF color indications.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCB's shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

**c) Earth Leakage Circuit Breakers (ELCB)**

ELCB's shall be four pole, current operated type with tripping current of 0.3A and tripping time not more than 0.1 seconds.

**6.2 Transformers/Meters etc.**

**a) Current Transformers**

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / 1A as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

**b) Voltage Transformers**

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of accuracy class 1.0.

Voltage Transformers shall be equipped with primary fuses with an interrupting

capacity of the incoming circuit breakers. Test terminal block shall be provided for each Voltage Transformer system.

**c) Ammeters and Voltmeters**

Indicating instruments shall be semi-flush Switchboard type, moving Iron, spring controlled with standard scale having white background and black graduations and markings. The front dimensions shall be 144 x 144 mm for instruments on incoming side and 96 x 96 mm on all outgoing circuits.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of current transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

**d) Selector Switches**

Ammeter and voltmeter selector switches shall be complete with front plate, grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

**e) Push Buttons**

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

**f) HRC Fuses**

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class Q1 in accordance with BS 88.

**g) Pilot Lamps**

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

**h) Line up Terminals**

Line up terminals wherever provided for Control or Power circuits shall be suitable for voltage and size of conductors as indicated on drawings. The Line up terminals for controls shall be suitable for channel mounting. All necessary

accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

**i) Secondary Wiring**

All wiring shall be copper conductor, thermoplastic insulated, at least 1.5 sq. mm flexible, neatly arranged and clipped in groups.

Each conductor and its termination are to be identified and marked with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not less than 2.5 sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

## **7. POWER FACTOR IMPROVEMENT PLAN (PFI)**

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall be automatic cum manual.

The PFI plant shall be aligned with main LT switch board and it shall be a part of that LT switchboard as shown on the drawing. The capacitors shall be suitable for three phases, 415 volts 50 Hz system and shall be self cooled, designed for indoor use in tropical climate for maximum ambient temperature of 45 degrees centigrade and relative humidity 90%. The capacitors shall be in the form of banks divided for 12 stages, 6 stages and 4 stages. Each capacitor bank unit shall be 12.5/25 and 50 KVAR. The total KVAR capacity shall be as indicated on the drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The panels shall be supplied complete with a set of 3-phase, full capacity, isolated tinned copper bus bars, interconnections, risers, designation labels, cable sockets, holding down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. Each control panel shall comprise.

1 No. Multi stage power factor correction relay for automatic/manual control.

1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.

1 No. Auto-off-Manual selector switch

1 No. Current transformers with 5 amps secondary current having suitable output burden and accuracy.

3 Nos. Instrument protection fuses.

Following equipment shall be provided for every 250 KVAR capacitor bank:

- 1 No. 630 amps, triple pole 415 volts air break contractor with auxiliary contacts (2 N.O+2 NC)  
Contractor shall be suitable for AC 3 duty.
- 1 Set of 2 Nos 630 Amps H RC back-up fuses with base and carrier.
- 1 Set of ON and OFF push buttons.
- 1 No. Red lamp for "ON" indication to the contactor.

#### **Requirement of Capacitor Banks**

According to IEC-83 1 -1 and 831-2.

Fully insulated terminals to be shielded by a cover.

Dielectric: Plastic poly-propylene, impregnated.

Electrodes: Aluminum coating vacuum metalized.

Safety features: Self healing. Over pressure tear-off fuse.

Withstand switching operations safely.

Maximum in rush current 200 times rated current.

Loading capacity: 1.1 times rated voltage. 1.3 times rated current at delta max.

Overloading capacity 1.5 times rated output at delta max.

Acceptable tolerances - 5/+ 10% of rated output at rated frequency.

Static life expectancy > 100,000 operating hours.

Test Specifications: Terminal versus terminal with an AC voltage 2.15 times rated voltage for 10 seconds duration. Terminals to casing with an AC voltage of 3 KV for 10 seconds duration.

## **8. INSTALLATION**

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall coordinate with civil & allied works for providing any openings, holes, etc. to avoid any breakage. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer.  
The cable armor shall be connected effectively to ground.

The Switchboard enclosure shall be connected to earth terminal. The Switchboard shall be tested before energizing in the presence of the Engineer.

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## **SECTION - C**

### **LOW VOLTAGE CABLES AND WIRES**

#### **1. SCOPE OF WORK**

The work under this scope consists of supply installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with project Engineer and coordinate at site with other trades for exact route, location and positions of electrical cables and equipments etc.

#### **2. GENERAL**

All multi-core and single core wires for light circuits, socket outlets and circuits operating up to 250 volts shall be 300 / 500 volts grade. All single core sheathed cables shall be of 450 / 750 volt grade. Power cables for main feeders, main to sub-main feeders, power equipment, etc., armored or unarmored shall be of 600 / 1000 volts grade. Armoring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded or solid, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multi-core cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures. Cable should be capable of running 125% of full load current without any damage.

#### **3. STANDARDS**

All Cables & Wires shall be manufactured to confirm the following standards as given below:

BS 6004 / 6346	PVC insulated cables for lighting and power.
BS 6746	PVC insulation for electrical cables.
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.

#### **4. MATERIAL**



#### **4.1 General**

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings. The single core cables shall be delivered as complete coils with wrapping & seal intact.

All cables shall have phase identification colors on insulation of each core. The color code for three phase circuits shall be red, yellow and blue for phases, and green for earthing.

Single phase circuits shall have insulation of red color for phase / line, black color for neutral and green color for earth conductor.

All DC circuits shall have insulation of red color for positive, black color for negative and green for earth conductor.

The ends of each length of multi-core armored or unarmored cables shall be properly marked for clock-wise and anti clock-wise sequence of core colors.

#### **4.2 Cables for Conduit Wiring**

All cables / wiring in concealed or surface mounted PVC or MS conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

#### **4.3 Cables on Surface / Concrete Trenches**

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multi-core PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

#### **4.4 Underground Installation**

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armored with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ.

#### **4.5 Cable Accessories**

All cable accessories such as lugs, ties, tapes, glands, flexible pipes, connectors, duets, clips, tags, bushes, etc shall be provided for the complete cabling and wiring system without any additional cost.

### **5. INSTALLATION**

### **5.1 General**

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying I KV - 30KV and other cables.
- 20 cm at least between a cable carrying voltages between 50V - 500V, and any power or control 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labor, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

The wiring must be strict in accordance with layouts, details, schematic diagrams given in the drawings.

The light circuit and power circuits shall be run in separate pipe. The circuits/sub-circuits shall be provided identifications by numbers permanently attached. The wiring shall be done to maintain color coding.

### **5.2 Conduit Wiring**

The wiring in conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 50 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care to prevent damaging the wires, preferably without the use of any lubricant like soap, oil or grease. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

The size & quantity of cables contain in one pipe shall not be excess in accordance with IEE regulations.

### **5.3 Cables on Surface / Trenches**

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc. Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks housed in outlet boxes.

The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

#### **5.4 Underground Cables**

The Contractor shall plan and take special care to prevent any damage to existing underground facilities such as piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, underground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

Sufficient slack shall be left in cables for this purpose that cut lengths of cables shall allow about 3% more in the measured lengths between terminations.

Cables, whether installed underground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment termination, where cable enter or leave underground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of polyurethane

foam / bituminized Hessian or equivalent method as approved by the Engineer.

### **5.5 Cable Termination and Joints**

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Engineer.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armored cables are used, care shall be taken to ensure that the lay of the armor is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.

Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made either by soldering or by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be affected by means of cable coupler. Cable couplers and

connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

The insulation of cables must be brought into DB's switch boards or fixtures to which the cables are connected. All openings shall be sealed properly. The outdoor apparatus shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

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## **SECTION - D**

### **CONDUITS AND PIPES**

#### **1. SCOPE OF WORK**

The job includes supply and installation of all Conduits, Pipes and Accessories as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical conduits.

#### **2. GENERAL**

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, bushes, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes.

#### **3. STANDARDS**

The conduits, pipes and accessories shall confirm the following standards:

BS 31	MS Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

#### **4. MATERIAL**

##### **4.1 PVC Conduits, Pipes and Accessories**

The PVC conduits and accessories for lighting and power circuits shall be standard manufactured length of high tensile strength and sufficiently flexible to provide resistance against breakage. It should not dent or flatten under pressure and it should be chemical resistant to chemical action of the atmosphere. The conduit shall be self extinguishing and should not support combustion.

The PVC conduit withstand against concrete additives, electrolysis, corrosive

atmosphere, soils, salts or excessive humidity and should be non-magnetic to reduce voltage drop and minimize power loss. The conduit should be non-conductive & non-sparking.

The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 64 mm diameter and 64 mm depth. The junction boxes for wall light points shall have minimum dimensions of 57 mm diameter and 40 mm depth. Round junction boxes shall be provided with one piece Bakelite cover plate fixed to the box by means of galvanized screws.

The PVC pipe shall be rigid and shall be minimum **d** class, unless otherwise stated on Drawings or Bill of Quantities. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

#### **4.2 PE Conduit & Accessories**

The PE conduits & accessories shall be corrosion resistant, non-toxic, light weight, impact strength, weld ability and abrasion resistance. It should be manufactured as per ISO 4427 and other international standards.

#### **4.3 MS Conduit and Accessories**

All conduits shall be of 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide (antirust paint) and finished in first quality black enamel paint. The coating shall be of heavy enamel, which shall not flake or crack during installation and handling. Each conduit length shall be furnished with threaded ends and a threaded coupling at one end. Soft metal bushes shall be provided at conduit termination to prevent damage to cable during pulling operation.

Junction boxes shall be 100 mm square, having minimum depths of 38 mm or 65 mm as required for accommodating the number of wires. The junction box shall be 16 SWG sheet steel provided with anti-corrosion paint and finished in heavy black enamel paint. The cast Iron outlet boxes for light points shall be round having 50 mm diameter and 63 mm depth. The above dimensions are given as minimum only, and the exact size shall be determined by the Contractor keeping in view the ease of Installation and maintenance. All outlet boxes and junction boxes shall be provided with one piece Bakelite cover plate of suitable design.

#### **4.4 Galvanized Iron Pipes and Accessories**



The G.I. pipes shall be galvanized from inside and outside by hot dip galvanizing method. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. pipes shall be galvanized from inside and outside. The conduit shall be NPT threaded, with at least 5 complete threads and assembled with TEFLON tape.

#### **4.5 Inspection Boxes / Pull Boxes**

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have ebonite sheet of appropriate size fixed to the box by means of galvanized screws.

#### **4.6 Pull Boxes**

Pull boxes shall be made of 16 SWG sheet steel box, painted and finished to the same quality as the light Distribution Board. The boxes shall be 50 mm in depth for conduits up to 25 mm diameter, 63 mm in depth for conduits up to 40 mm diameter and 87 mm in depth for conduits up to 50 mm in diameter. For conduits more than 50 mm in diameter, the minimum depth shall be two times the diameter.

#### **4.7 Conduit / Pipe Accessories**

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

### **5. INSTALLATION**

The contractor shall provide all conduits & accessories for the installation as required. The drawings shows the approximate & terminal points of conduits. However if for any reason the contractor desire to use any alternative route, he may do so at his own responsibility without interference with other installations and get the prior written permission from Engineer.

Conduits shall be run atleast 150mm from flues, steam or water pipes. Where multiple conduits runs, these shall be arranged symmetrically to present a uniform and neat arrangement. The minimum size of conduit shall be 20mm diameter unless notified otherwise. Conduits are installed to confirm the location of conduit to avoid obstructions, furnaces, hot lines & other places of high temperature.

#### **5.1 PVC Conduits - Concealed**

The conduit shall be installed concealed in roof, wall, column, etc.

At all joints and bends, PVC jointing solution of approved make must be used to strengthen and to seal the joint.

Manufactured smooth bends shall be used. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of 90 degree bends and tees will not be allowed.

The conduit shall have a minimum of 38 mm cover of concrete. The conduit shall be laid above the steel of the slab and shall be firmly secured by tying to steel. Under any circumstances RCC structures chiseling not to be made.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed in cement concrete work or in block masonry, the chiseling shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture to have to at least 25 mm cover before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chiseling and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact locations of the termination shall be confirmed with the Switchboard / Distribution Board to be installed. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before plastering. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out. Water that has entered in conduit shall be removed by drawing swabs through the conduit. No cable shall be pulled until the water has thoroughly dried out.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.  
For straight runs the spacing shall not be more than 30 meters.  
For runs with one 90 degree bend, the spacing shall not be more than 15 meters.
- Adaptable boxes.  
For conduits up to 25 mm diameter, the boxes shall be 50 mm in depth.  
For conduits up to 40 mm diameter, the boxes shall be 63 mm in depth.  
For conduits up to 50 mm diameter, the boxes shall be 87 mm in depth.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, offsetting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

## **5.2 Conduits on surface**

- a. The conduits accessories shall be firmly held with the surface of walls by means of PVC saddles, clamps, brackets etc. Rawal plugs or Phil plugs must be used for fixing such saddles etc. The saddles shall be fixed at an interval of 750mm, depending upon the size & weight of conduit. The MS clamps, brackets etc shall be painted anti-corrosion paint before and after fixing.
- b. In all areas where the conduit is exposed to damp or wet conditions, brass or stainless steel screws must be used for fixing.

## **SECTION - E**

### **WIRING ACCESSORIES**

#### **1. SCOPE OF WORK**

The job consists of supply, installation and commissioning of switches, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

#### **2. GENERAL**

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and Commissioning.

#### **3. STANDARDS**

All wiring accessories shall confirm to the following international standards:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and un-switched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interference suppression
- BS 3676 Switch for domestic and similar purposes.
- BS 4934 Safety requirements for electric fans and regulators.
- BS 5060 Performance of circulating fans and their regulators.

#### **4. MATERIAL**

##### **4.1 Switches**

Switches for controlling light and fan points shall be single pole, rated for 10 Amp, 250 VAC. The body of switches shall be made of poly carbonate / urea with white face plate suitable for flush mounting on sheet steel outlet box. The switches shall be gang type having silver tipped contacts and operate with snap action.

The fixing of plates on outlet boxes shall be means of flat head counter sunk galvanized screws with the head of the screw finish flush with the surface of the plate. Except for

switches controlling light points, all single switches for fans, sockets, etc., shall have identification symbols on the operating levers.

Two way switches shall be used to control lights from two different locations as shown on the drawings.

#### **4.2 Switch Socket Outlets**

Switch socket units shall be conformed to BS 1363. 2 and 3 Pin rated for 5 Amps. or 2 Pin rated for 5 Amps, 250V.

3 Pin 5 Amps./15 Amps switch sockets shall be mould type having white plastic face plate, suitable for mounting on a sheet steel box of appropriate dimensions. Switch sockets shall have shrouded live contacts such that the earth pin is engaged to socket earth before making with the live contacts. Where specified, the switch socket unit shall have spring loaded dust tight cover for mechanical protection.

#### **4.3 Sheet Steel Boxes**

The outlet boxes for installation of switches, fan dimmers and socket outlets shall be 16 SWG sheet steel having appropriate dimensions. The boxes shall have suitable knockouts or welded nipples for receiving the conduits. An earth terminal shall be provided for connecting at least three earth wires of 4 sq. mm. The outlet boxes shall be given two coats of anti-corrosion red oxide and one coat of enamel before installation. The boxes shall be suitable for mounting flush with the surface of wall or on the surface of wall as may be required. The boxes shall not be less than 75 mm x 75 mm (3" x 3"). All boxes shall be water tight where installed in the vicinity of liquids.

#### **4.4 Ceiling Rose**

The ceiling rose shall be suitable for 5 Amps. 250V AC. It shall have white plastic molded base plate, copper or brass terminals for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole for multi-core PVC insulated and PVC sheathed cable.

#### **4.5 Fans**

The fans shall comply with BS 380 as far as constructional requirements, range of fan speed, speed regulator starting, radio interference silent operation and temperature rise is concerned. For testing BS 848 as amended 1 960 shall be complied with.

##### **4.5.1 Ceiling Fans**

The ceiling fans shall be three blades capacitor type, mounted with ceiling by means of pre-installed fan hook. The fan shall be suitable for operation on 250V AC with  $\pm 10\%$  tolerance.

The sweep of the fan shall be as given in BOQ drawings. Fans shall be supplied complete with fan coil unit, capacitor, suitable fan rod, canopy etc.

#### **4.5.2 Bracket Type**

The bracket type fans shall be suitable for mounting on the wall and suitable for operation semi-horizontally. These shall operate satisfactorily on 250 volts, single phase, 50 Hz, A.C. supply with + 10 % tolerance.

The sweep of the fan shall be as given in BOQ/drawings.

#### **4.5.3 Exhaust Fan**

The exhaust fans shall be three blade types, mounted on the steel/plastic structure of its own, which will be fixed to the structure by means of suitable grouted foundation bolts. The fan shall be suitable for operation on 250 VAC with + 10 % tolerance.

The sweep of the fan shall be as given in Bill of Quantities/drawings. Fans shall be direct driven and supplied complete with electric motor, back draft dampers and anti-vermin screen. The bearings shall be ball, roller or sleeve type of permanently lubricated and sealed type. Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically and free from objectionable vibration or noises.

## **SECTION - F**

### **LIGHT FIXTURES**

#### **1. SCOPE OF WORK**

The job consists of supply, installation and commissioning of all light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact location/positions of light fixtures.

#### **2. GENERAL**

The Contractor shall submit samples of each and every light fixture specified and obtain approval of the Owner/Engineer before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

#### **3. STANDARDS**

The light fixtures shall confirm the following standards:

- IEC 81            Tubular fluorescent lamps.
- IEC 82            Ballast for tubular fluorescent lamps.
- IEC 155          Starters for fluorescent lamps.
- IEC 400          Lamp holders and starter holders for fluorescent lamps.
- IEC 566          Capacitors for use in TL, HP Mercury and LP sodium vapor.
- IEC 598          Luminaries.
- BS 3677          Discharge lamp circuits.

#### **4. MATERIAL**

##### **4.1 Fluorescent Light Fixtures**

The fluorescent light fixtures shall have lamps and ballast of proper rating as shown on the drawings. Each lamp shall be provided with independent ballast.

The fluorescent lamps shall be tubular type and 36/18 watts. The fluorescent color shall be warm white characteristics with an average output of 3350 lumens (+5%) for 36 watts and 1350 lumens (+5%) for 18 watts after 100 burning hours. The ballast shall be

polyester filled type, totally enclosed and suitable to operate up to 250 VAC. The power loss shall not be more than 9 / 6 watts for watts ballast. A wiring, diagram, wattage, voltage and current figures shall be printed on the body of the ballast.

The lamp holders shall be rotary lock-in type. The starters shall be glow type with radio interference suppressor / by-pass capacitor. The internal wiring of the fluorescent light fixtures shall be done with heat resistant wires at the manufacturer's factory. All light fixtures shall be provided with power factor improvement capacitor to give a minimum power factor of 0.90.

The body of the fluorescent light fixtures shall be minimum 22 SWG sheet steel, de-rusted, degreased, finished in heat resistant paint, stove enameled. Appropriate size bushed wire entry holes, fixing holes and earth terminals shall be provided. Connectors suitable for connecting 2.5 sq. mm cable connectors shall be provided for supply connections. An earth terminal for connection to 2.5mm sq. wire shall be provided.

The light fixtures shall be furnished with perspex diffusing panels " 040 opal acrylic" (minimum sheet thickness 3 mm), polystyrene louvers or metal grid louvers or mirror optic reflectors, etc. as specified on the drawings or in BOQ. The louvers shall be secured firmly and in level. The polystyrene louvers shall be white Egg Crate or as approved. The louvers shall be in one section and not in pieces.

The design of light fixture for recess mounting shall be coordinated with the design of false ceiling prior to commencement of manufacture.

#### **4.2 Incandescent Light Fixtures**

The light fixture shall be finished in standard colors unless otherwise stated on drawings or directed by Engineer. All incandescent light fixtures shall be of international standard and quality. This type of fixtures with manufacturer catalogue reference are given on the fixture schedule and in Bill of Quantities. Equivalent fixture may be acceptable provided that the Contractor submits for review all necessary data indicating photo-metric curves to show that the fixture proposed are of the same type, construction and quality.

The lamps for incandescent light fixtures shall be GLS/EPLC lamps and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof bulk head incandescent light fixture shall comprise of cast aluminum body and gas-kitted clear glass cover secured to the body by means of galvanized nuts / screws to give a weather proof and water tight fit. A wire guard shall be provided for protection of front glass against mechanical injury. The gasket shall be weather resistance type. A G.I. wire guard shall be provided on the glass cover. The lamp holder shall be of bi-pin brass having porcelain outer ring.



The glass shade of light fixtures shall be opal white or clear and free from any air bubbles or voids. The shade may be spherical, cylindrical, flattened bottom or any other shape as specified in the drawings or BOQ. The glass shall be opal white or clear as furnished by the manufacturer with the light fixture unless specified.

#### **4.3 water proof light fixtures**

The underwater lights shall be suitable for 24V, 80Hz Dc. The DC supply shall be available from a step down transformer. The fixture shall be completely water tight and shall have scaled reflector flat lamps.

#### **4.4 flood light fixtures**

The flood light fixtures shall have cast aluminum body, angle adjustable stand, polished mirror reflector and clear front glass. The flood light fittings for outdoor use shall be weather proof type having rubber gas-kit ring to fit of the front glass.

## **5. INSTALLATION**

### **5.1 General**

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between ceiling rose or terminal box of the fixture shall be carried out with 3 core 0.75 sq. mm, PVC / PVC cable. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffuses, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

### **5.2 Fluorescent Light Fixtures**

The fluorescent light fixtures on the surface of ceiling shall be installed with the back of the body flush with the ceiling surface, and in a manner so as to facilitate wiring. Nylon plugs and galvanized steel bolts or screws shall be used for fixing the light fixture to the ceiling. The recessed type shall be light fixtures installed on false ceiling, the installation

method detail shall be coordinated with ceiling design and submitted for approval of Engineer. The installation shall include cutting and making of holes in false ceiling. Care shall be taken to prevent the weight of the fixture from being transferred to the false ceiling.

Pendent light fixtures shall have two holes in the top of each casing by a 1/4" diameter galvanized pipe or any other standard method as approved by the Engineer. Wiring from ceiling rose to the fixture shall be installed through the pipe. Proper arrangements such as long threads with check nuts, etc. for minor adjustment in the mounting heights of the fixtures shall also be provided.

### **5.3 Incandescent Light Fixtures**

The incandescent light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in a manner as described for fluorescent light fixture.

### **5.4 Outdoor Lighting**

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such.

In case, the specified materials and equipment are not used, the Contractor shall then essentially use the standard products of a manufacturer, regularly engaged in the manufacturer of the product and shall meet the requirement of the specifications.

### **5.5 Emergency lights:**

- The emergency light fixtures shall be IP 65 polycarbonate construction suitable for interior/exterior applications. The florescent lamps shall be 2x8Watt, T-5, and batteries shall be self contained version – sealed nickel cadmium.
- The fixtures shall be suitable for ceiling/wall mount.
- The duration for emergency lights shall be 3 hours, maintained and non-maintained operation.

## **SECTION - G EARTHING SYSTEM**

## **1. SCOPE OF WORK**

The job consists of supply, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

## **2. GENERAL**

All exposed conductive non-current carrying parts of switchgear, boxes, trays, fixtures etc should be efficiently earthed. It should be separate with the earthing of transformer or generator. The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

## **3. STANDARDS**

Following standards should be applicable:

BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

## **4. MATERIAL**

### **4.1 Earth Rod Electrodes**

Drive extensible rods of the same diameter into the ground, either manually or by power driven hammer, to a suitable depth to obtain low resistivity in the particular soil.

Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

### **4.2 Earthing Lead**

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be round hard drawn bare electrolytic copper of size

shown on the drawings.

#### **4.3 Earth Continuity Conductor**

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided & installed.

The earth continuity conductor should form a continuous path from any point of installation to the earthing sets. When two earthing sets are provided for same mains, these shall be at least 6m apart. The earthing lead shall be taken up to the earthing electrodes in a 32mm of G.I. pipe irrespective of wiring system, and shall be efficiently bounded to the earth electrodes by means of sweating socket, brass nut, bolts, etc. to make a permanent and positive connection with the earthing electrodes. The other end of the earthing lead shall be sweated into a cable lug of a correct size for the wire for its connections to the main apparatus to be earthed.

### **5. INSTALLATION**

The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, without ground pits water spraying.

The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape amours are not permitted as earthing conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to any metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be generally run in cable trench or in conduits / pipes or in cable trays as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or 1 meter below permanent water level, whichever is less. The minimum horizontal distance

between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1:3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter UPVC pipe shall be provided from inspection chamber to earth plate for watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a copper supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

## **SECTION - H**

### **STANDBY GENERATOR**

## **1. GENERAL**

The project is designed to have standby generator. It shall serve lighting, sockets and air handling units, lifts, telephone exchange, fire and security room, server room, CCTV system and any other use as may be defined by the CONSULTANTS, within the confines of its capacity.

## **2. GENERATOR INSTALLATION**

Generator unit shall comprise of diesel engine and alternator assembly directly coupled by alignment flange mounted on rigidly constructed base frame provided with anti-vibration mounting pad, mounted on skid under base frame (double base frame).

The generator set shall be auto-mains failure type and manufactured as per B.S. 5649 and B.S. 2613.

## **3. CABLING & CONTROL WIRING**

Generator panel shall be separately mounted, cubicle design, floor mounted incorporating circuit breaker, voltmeter, ammeter selector switches, indication lamps KWH meter. The CONTRACTOR will be required to install the panel and make necessary power wiring between generator, generator panel and change over switch. He will also be required to provide necessary interconnections of low current control cabling.

## **4. EXHAUST PIPING WORK**

From engine, exhaust pipe shall be laid to muffler and onward to the exterior. The exhaust pipe shall be 150mm dia. MS pipe. The pipe shall be wrapped with asbestos or glass wool insulation. The pipe shall be securely and firmly supported to structures. The hangers shall be strong enough to hold and withstand thermal expansions and vibrations. At the end of exhaust piping, rain protection canopy shall be provided.

## **5. BIRD GRILL & RAIN GUARD**

At the neck of radiator, the radiator exhaust shall be directed to atmosphere from basement roof through flexible exhaust duct. The duct shall be fabricated of 1.6mm G.I. Sheet having U-section fixed to canvas bellows of good thickness.

Bird grill shall be provided against the canvas bellow and shall match the size of radiator opening and shall be approximately 900 x 1200mm or as per manufacturer's requirements, in size made of 10 SWG G.I. wire. The grill shall be complete with angle iron framing and holding down

hardware.

Rain guard shall be provided next to bird grill to protect radiator from rain. It shall be fabricated of **12 SWG** G.I. Sheet and shall be complete with framing and holding down hardware.

## **6. FUEL PIPING & FUEL PUMP**

Fuel piping shall be provided from barred drums to daily service tank, from service to engine and residual fuel from engine to daily service tank. The pipe shall be 25mm dia. M.S. with threaded coupling. Necessary gates/valves are required at different stage shall be provided.

For the transfer of fuel from barred drums to daily service tank hand operated mono-pump together with necessary flexible piping shall be provided.

## **7. APPROVAL FROM ELECTRIC INSPECTOR**

The generator installation requires approval from Electric Inspector. The CONTRACTOR will arrange approval from the inspector, and any modifications required for such approvals shall be done by CONTRACTOR at his own cost.

The generator room is required to have necessary operation and maintenance charts, voltage and caution signs, rubber mats, etc the CONTRACTOR will take care of the same.

## **SECTION – I**

### **LIGHTNING PROTECTION SYSTEM**

## **1. GENERAL**

The system of lightning protection shall be installed so as to protect the building against lightning.

## **2. QUALITY ASSURANCE**

Engage an experienced manufacturer who produces system components made of high quality materials as listed herein. Engage an installer who is listed or who is certified by the Lightning Protection Institute as a Master Installer.

Life service of the materials used shall not be less than 30 years.

Lightning protection shall conform to BS-6651.

## **3. SEQUENCING AND SCHEDULING**

Coordinate installation of lightning protection with installation of other building systems and components, including supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

## **4. COMPONENTS:**

### **a) Air Terminal**

It shall be of taper pointed copper air terminal 1000 mm long 15 mm diameter with base and installed above the finish floor level. The air terminal shall be complete with single pointer rod of high tensile brass bar, it shall be reinforced so as to withstand the excessive pressure of air during storms. Use all accessories for fixing as recommended by the manufacturer. All accessories shall be made of copper. Bare copper tape shall be of copper, minimum 25 x 3 mm size similar to Furse TC-030 or equal.

### **b) Down Conductors**

70sqmm PVC Copper conductor in surface GI pipe connected to tape protective conductors on roof down to the test link for earthing as indicated on the drawings. Each down conductor shall be equipped with independent testing points, earth termination lead & earth. The earth termination lead shall be of copper strip as per drawing.

The whole of the earth termination network should have a combined resistance to earth not exceeding 10 Ohms without taking into account any bonding to other services.

Provide horizontal bonding tape around the building at every 10 meter as per BS Standard.



## **5. INSTALLATION**

Install lightning protection as indicated, according to manufacturer's written instructions.

Comply BS-6651.

Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

Bond extremities of vertical metal bodies exceeding 60 feet (18m) in length to lightning protection components.

## **6. CORROSION PROTECTION**

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

## **7. FIELD QUALITY CONTROL**

Periodic Inspections: Provide the services of a qualified person to perform periodic inspections during or after completion of building.

## SECTION – J

### POWER TRANSFORMERS

#### 1. SCOPE

The scope of this section of specification is to supply install, test and commission the transformers. The transformers shall be installed at locations shown on the drawings. For installation details the manufacturer's recommendations is to be followed.

#### 2. SPECIFICATIONS

Transformers shall be from manufacturer's standard range complying with the requirements of the IEC 726 standards and shall be capable of delivering full rated output under the Site climatic conditions.

Transformers shall be of the indoor, Dry type, naturally circulated, naturally cooled, hermetically-sealed type, manufactured by SIEMENS or approved equal.

The step down transformer shall meet the following specifications.

- Type : ONAN
- Voltage ratio at no-load : 11000 / 3300 volts.
- Frequency : 50 Hz
- Vector Group : Dy 11
- HV connection : 11000 V Delta
- LV connection : 3300 V with grounded star point.
- Impedance voltage : 4.5% to 6%
- Voltage regulation for rated : Not to exceed 2.5% of no-load  
operating condition at 0.85 P.F. secondary voltage.

The transformers shall be provided with the following accessories.

- Double float Bucholz relay for alarm and tripping with testing facility.
- Silica gel breather, with oil bath
- Lifting Jugs
- Bi-directional rollers.
- Pressure release safety valve.
- Temperature protection system with thermostat & protection relay.
- Anti Vibration Pad
- Earth terminal
- Dial level gauge
- Dial type thermometer with maximum temperature indicator pointer.
- Diagram and name plate

- Pressure Release safety valve
- Off-load tap changer fitted with position indicator and pad-locking arrangement.
- HT porcelain bushings with protective spark gaps.
- LT and neutral porcelain bushings.
- Cable Termination Box on LT and HT side

Maximum winding temp rise shall be 40 degrees centigrade and top oil temperature rise shall be 60 degrees centigrade over ambient temperature.

Neutral (star point) of the secondary windings shall be brought out and earthed directly to the sub-station earthing system.

(i) Tappings

Transformers shall be provided with tapings on the HV windings, at plus/minus 2.5% ,5% & 7% of nominal and shall give their full rated output on any tapping. The tap changer shall be an externally operated off-load device of robust construction, especially designed against risk of damage from short circuits and having all contact surfaces of ample area for satisfactory operation during overloads.

The mechanism shall be manually operated and shall come to rest only when the switch is making full contact. At all times, clear indication shall be given of the ratio at which the transformer is operating. Means shall be provided for locking the tapping switch mechanism in the position corresponding to each voltage ratio.

(ii) Construction

The transformer tank shall be of sheet steel construction suitably stiffened so that the transformer may be lifted and transported without permanent deformation. The transformer shall be fitted with lugs suitable for lifting and jacking the complete unit. The tank shall be provided with a skid under-base with removable wheels to allow the transformer to be moved in any direction.

Tanks and covers shall be designed such that there are no external pockets in which water can collect.

Tank and terminal box joints shall be fitted with gaskets to prevent entry of water. Gaskets shall be of a suitable non-absorbent material. Joint faces shall fit properly and no additional thickness or jointing shall be used to make good irregularities.

The top cover shall have a substantial flange and adequate number of bolts fixing the cover to a similar substantial flange on the transformer tank. The gasket provided at this joint shall be of synthetic rubber bonded cork. Conservator tank shall be provided with Silica gel breather to allow for expansion of oil.

The initial filling of oil shall be carried out at such a temperature that the pressure in the tank is at a minimum. The space above the oil shall be evacuated and filled with dry clean nitrogen. The pressure of nitrogen inside the top cover shall not exceed 0.35 kg/sq.cm. A pressure relief diaphragm device shall be incorporated in the top cover having a bursting pressure of 0.56 kg/sq.cm.

(iii) Instrumentation

Fluid filled transformer shall be provided with:

a thermometer having a re-settable pointer for registering the maximum oil temperature  
Bucholz relay with alarm & tripping features.

(iv) Rating Plate

The transformer shall be provided with a rating and diagram plate made from stainless steel.

(v) Earthing

Transformers shall be earthed by means of substantial connections to the tank or case and terminals for this purpose shall be provided at the base of each unit.

(vi) Cable Boxes

Cable boxes shall be provided for the cable connections to the primary and cable/bus duct to the secondary windings. The cable boxes shall be suitable for use outdoors and for bottom/top entry cabling. The boxes shall be air-insulated type, suitable for XLPE/PVC cable/copper bus duct. The cables shall be terminated using the heat shrink termination method.

## **SECTION – K**

### **UNDERGROUND TRENCH & PIPES**

#### **1. UNDERGROUND TRENCH**

- i. The underground trench for installation of underground cables and wires through pipes, etc. shall be provided internally and externally as shown on the drawings. While the routes for external runs are to be followed taking into account clearance from underground sanitary and water supply pipe lines, etc., those required internally are dependent upon the type and size of equipment being installed in the substation and equipment rooms, etc., and hence this shall have to be specially modified on the basis of the requirements of the equipment manufactures or suppliers.
- ii. The layout and the design of the duct shall be approved by the CONSULTANTS before actually commencing the work on it. All other trades shall have to be coordinated while deciding the alignment of underground trenches. The construction of the trench shall be totally water proof such that no seepage or leakage of water takes place either from top, bottom, or sides.
- iii. The cables/pipes shall be supported to two horizontally placed metal supports of 37mm x 6mm angle iron and duly clamped at interval not exceeding 750mm. A covering of 3.8mm thick of soft but indestructible by heat material shall be applied to un-served cables. The supports shall be staggered as detailed in Drawings.
- iv. The angle iron shall be buried in the trench masonry at the time of construction.
- v. The trench shall be absolutely clean when the cable is laid.
- vi. Suitable slope shall be provided in the floor of the trench and the lowest point shall be connected to the drainage system so as to ensure self-drainage of water, if any.
- vii. Trench inside the building shall be covered with 5.5mm, M.S. checkered plates.
- viii. The trench outside the building shall be RCC/UPVC pipe of required diameter with watertight joints, and shall be laid at least 2 below grade.
- ix. The main holes of the trench shall be left open till cable is pulled in and positioned. Thereafter the trench shall be covered with RCC slabs and mortar.
- x. The main hole covers outside the building shall be of cast iron water proof type of the size of openings indicated on the drawings. The covers for the inside trench however, shall be of 5.5mm thick checkered plates.

- xi. The CONTRACTOR shall arrange to provide for a water tight entry of cables where these enter in the building. This shall be done by the use of UPVC/CC pipes provided one for each cable in a reverse slope and with bitumen filling of the end.
- xii. Where trenches are left open overnight and where roads are being cut in the day or night; the CONTRACTOR shall exhibit suitable danger signals such as banners, red flags and red lamps at his own cost.
- xiii. If any damage is done, to the existing cables, etc., the cost of making goods such damages or entire replacement shall be recovered from the CONTRACTOR.
- xiv. The road cuts and filling shall be filled up and suitably watered and cement shall not be laid until all subsidence stops and no time shall be lost in putting the cement concrete. Wet gunny bags shall be spared over it for a period of not less than three days in order to allow full setting of the cement concrete.
- xv. All the trenches shall be watered and rammed properly before final dressing. The same applies to lawns public or private but here in place of cement filling some manure of good quality shall be utilized. The turf shall be carefully rammed and preserved in a convenient place before excavation and shall be re-laid after filling up, watering and maturing is completed.
- xvi. The road cuts shall be filled up first with mud concrete in the proportion of 1:2 up to 150mm below the road level and after consolidating it properly 150mm of concrete in cement shall be laid over it, but in the case of bitumen surface of road the top dressing are to be adjusted.
- xvii. The trenches shall be dug until the CONTRACTOR is certain that the cable is available for laying in it.
- xviii. Wherever cables are required to be installed inside a Building or in any other masonry or channel work, it shall be done neatly by use of cleats or any other device as directed by the CONSULTANTS.
- xix. Cement concrete pipes or G.I. pipe whichever is required shall be provided for all road crossings and nothing extra will be paid for these. The size of the pipe will be decided by the CONSULTANTS. These pipes will be laid direct in the grounds without any bed without pacca joint. No sand cushioning or tiles used in such situations.
- xx. Cables shall always be laid out or laid into the ground through 200mm long C.C. pipe of suitable size. Nothing extra will be paid for this pipe. A reasonable length of cable in the form of coil shall be left at ends of the underground run of the cable for subsequent use.

- xxi. Where road berms have been cut or curb stones displaced, the CONTRACTOR shall repair all damages to the satisfaction of the CONSULTANTS and all surplus earth or rock removed to a suitable dumping place which will be indicated by the CONSULTANTS. Where in the course of excavation lawns or roads have to be cut it shall be done in such a way that the turf removed can be re-laid. If this condition is not fulfilled the OWNER shall get the work done by other agency and recover the cost from the CONTRACTOR.

If any damage is done to any other service during the execution of the work, the whole cost of making good such damage shall be recovered from him and where such damage is excessive or deliberate, it shall amount to breach of the terms of this CONTRACT, the CONSULTANT may at his discretion take appropriate action at the cost of the CONTRACTOR.

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## **Section - L**

### **Cable Tray System:**

- i. The cable trays shall be fabricated by prime quality 1.6mm MS sheet steel or GI sheet, solid or perforated and painted powder coated RAIL- 7032. Supply and install all accessories like tees, bands, elbows, risers, etc. to complete the cable tray system.
- ii. The length should be standard of 2.44 meters.
- iii. All fixing or supporting accessories shall also be provided & installed like hangers, brackets, clamps etc.
- iv. The cable trays shall be capable to support all type of wiring like high voltage, medium voltage, low voltage etc. it should be fabricated with the standards laid down by NEMA. For internal areas, it should be mill galvanized.

For external areas, the cable trays and accessories should be hot dip galvanized after fabrication. After fabrication process, all trays, ladders and accessories (bands, elbows, risers etc like nut, bolts, washers, tees) shall be dipped into liquid zinc bath, the surface including all cut edges being coated with a homogenous zinc layer to provide better protection against low chemical stress, marine air, urban air & other low atmospheric influences which activate corrosion.



## **SECTION – M**

### **VOICE & DATA COMMUNICATION SYSTEM**

#### **1. GENERAL**

The proposed cabling system for the UTP and Fiber network cabling and Fiber Links shall be an open system and application and vendor independent and shall be warranted by an International Vendor for a minimum of 20 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system.

A Main Patch Panel (MPP) shall be provided at the server room of the Building. The Patch panels are located as marked in drawings. The cable run from the Patch Panel to the associated outlet is limited to 90m. The cable run must be free of bridges, taps and splices.

Wiring system used shall be star topology i.e. each data/voice outlet is connected directly to Patch Panel. Both ends of the cables shall be labeled to EIA/TIA 606 administration standards.

Transmission Media:

##### **For Data:**

Vertical runs between floors extending from the MDF to each Patch Panel in a star topology using fiber optic cables installed in cable trays.

Horizontal runs from a patch panel to the data outlets using CAT-6, 4 Pairs UTP twisted pair cables.

##### **For Voice:**

1. Vertical runs between floors extending from the MDF to each JTB using multi pair CAT 5 cables installed in cable tray.
2. Horizontal runs from a TJB to the telephone outlet using 2 Pair telephone cables.

Data & voice processing system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, adapters, connectors, patch panels, 110 wiring blocks, patch cords, cable management, floor distributors (racks/cabinets).

The Cabling System shall be designed using standard, proven equipment and materials with the latest technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost.

The design shall fully comply with EIA/TIA 568B & ISO 11801 in a full star topology configuration collapsing in the MDF.

The network data cabling systems support at least 1000 Base-T (Gigabit) Ethernet or faster protocol.

The UTP (unshielded twisted pair) Category 6 cable's technical specifications shall be up to the highest industry standards and should have performance specifications better than 250 MHz and should exceed all proposed requirements for data, video & Gigabit applications.

The UTP Category 6 cable's technical specifications shall be up to the TIA/EIA-568B.2-1 industry standards and should have performance specifications better than 250 MHz and ample margin compared to the Category 6 Standard for performance in factors such as NEXT.

Data & Voice cables may be drawn through the same conduits and raceways & terminated in separate face plates.

## **2. SCOPE**

The contractor shall carefully examine the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The LAN cabling system shall meet the emerging EIA/TIA 568A/B and ISO 11801 Category 6, Class E specifications and shall support Gigabit Ethernet, Sonnet/asynchronous transfer mode (ATM) at rates (minimum of) 1 GB/seconds and analog broadband video in addition to existing telecommunication and multimedia technologies.

The voice backbone cabling system shall meet the EIA/TIA 568A/B-5 and ISO 11801 Category 5E, Class D specifications.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labor, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

The Vendor must have completed a project with a minimum of 1000 points or higher of Category 6

The Vendor must have experience with minimum 500 points of fiber installed and terminated.

### **3. SUBMITTALS**

**Product Data:** Submit manufacturer's data on signal transmission media and components.

**Shop Drawings:** Submit layout drawings of computer cable distribution system and accessories.

**Wiring Diagrams:** Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

### **4. QUALITY ASSURANCE:**

#### For Manufacturer:

Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

#### For Installer:

Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

## **5. COPPER & FIBRE OPTIC CABLE AND CONNECTORS**

UTP Copper & fiber optic cables shall be approved & recommended by component manufacturer. This is to enable the component manufacturer to give the necessary product and application warranties for the system.

Provide UTP copper cable, fiber optic cable and connectors, in sizes and types as recommended by the active equipment manufacturer for indicated applications. Mate and match connector materials to factory installed equipment.

### Cabling Accessories:

Provide computer accessories, including modular wall and floor jacks, junction boxes, connecting blocks and pre-wired boxes.

The selection and type of material required for the Services shall conform to the specifications given herein and items or matters not specified herein shall conform to ISO/IEC 11801, EN 50173 and EIA/TIA 568B Category 6 Standards as applicable. The Contractor shall also ensure that the materials utilized to complete the Cabling System installation are capable of supporting the minimum expected performance requirements for emerging applications such as ATM services (1.2 Gbps), including 10 GB Ethernet. The complete system shall guarantee a minimum of 250 MHz & 100 MHz bandwidth performance and the products shall be from an internationally reputable manufacturer. The selection of materials shall be subject to approval by The Company.

The cables that are used to complete the installation shall be Category 6 UTP, capable of carrying high bit rate signals for extended distances in building distribution systems over frequency ranges up to and potentially beyond 250 or 100 MHz, designed to work on an ISO 11801 Class "E" link.

The cable shall be composed of 23 or 24 AWG bare, solid-copper conductors. The insulated conductors shall be twisted into individual pairs and four such pairs twisted together.

The cables shall be fully color coded as provided hereunder, color contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identification	Colored Code	Abbreviation
Pair 1	White – Blue Blue – (White)	WT – BL BL
Pair 2	White – Orange Orange – (White)	WT – OR OR
Pair 3	White – Green Green – (White)	WT – GN GN
Pair 4	White – Brown Brown – (White)	WT – BR BR

## 6. TELEPHONE SYSTEM

### 6.1 General

The work included under this section consists of furnishing of all labor, services and skilled supervision necessary for the construction, erection, installation and connection of all facilities specified herein and as shown on the drawings and/or normally required for the complete telephone system and its delivery to the owner on completion in all respects ready for use, except the main telephone exchange equipment (PABX) and telephone instruments which will be supplied and installed by the relevant authority in accordance with the requirements of the PTCL.

### 6.2 Telephone Services

The telephone service entrance location shall be coordinated with PTCL. For bringing in the service connection and underground UPVC pipe 75mm diameter shall be installed, a minimum 500mm below ground level and as shown on drawings. Pull wire shall be furnished and installed in the pipe line as recommended by PTCL.

### 6.3 Telephone Conduit System

The telephone conduit system, including telephone outlet boxes, rosettes, junction boxes, etc. shall be generally in conformity with the specifications of similar items given in BOQ and shall be in accordance with the recommendation of PTCL.

### 6.4 Telephone Junction Boxes

The telephone junction/terminal boxes shall be cubical design of 1.6mm sheet steel fabricated with a hinged door fixed flush with the wall and having built in concealed lock. The color of the box shall be powder coated RAIL 7032, and it shall be installed in such a manner so as to have easy access for service and repair. The TJB shall be vermin proof. It shall be made to accommodate tag blocks with indicating and marking arrangements.

### 6.5 Telephone Wiring

Wiring of telephone system will be done by multi-core PVC insulated and sheathed cables complying with BSS 2746. The conductor shall be of high conductivity tinned copper diameter 0.6mm. PVC insulated and PVC sheathed. All telephone cables shall be continuous between telephone outlets and junction boxes. All connections shall be made, marked and identified on tag blocks and socket outlets.

## 7. SPECIFICATIONS OF UTP CABLES:

Cable Type	Category 6 UTP
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Attenuation @ 250 MHz (dB)	32.1
Worst case NEXT @ 250 MHz (dB)	38.3

## 8. FIBRE OPTIC & UTP CABLING

The backbone cabling interconnecting distribution cabinets to the main Central distribution cabinet shall be of multimode fiber cable 50/125 microns; 12-core cable with color-coded fibers. All fiber optic cables shall be laid in straight run without intermediate splices and all fibers shall be terminated at either end using suitable fiber cable patch panels mounted on the wiring closets.

All fiber optic backbone links between the main cross connect and the Telecommunication rooms have a backup link using a different route from the main fiber optic link. Each of these links shall be 12-core fiber optic cable as described in this document.

The Contractor shall be responsible for the supply, installation, testing and commissioning of the complete fiber cable backbone interconnection/cross connection requirements of the "building/complex" LAN Cabling System.

The Contractor shall install suitable fiber optic pigtails/connectors needed to complete the entire fiber cable installation as per the manufacturer's recommendation and shall ensure that the backbone is capable to handle the traffic and provide error-free universal data transport for the foreseeable future.

The backbone Fiber optic cable shall be run either vertically between floors or horizontally to

connect wiring closets to the MDF.

The 12 core fiber optic cables shall be installed from the Main Cross-Connect to each Telecommunication rooms. The cable shall be tied down to the designated area at the rear side using cable ties around the outer jacket, leaving 2 to 3 meters of excess length of the cables, in addition to the length required to facilitate the termination process.

All of the fibers in the backbone shall be terminated with LC type connectors at the time of the installation. The Contractor shall ensure proper testing of the fibers and make them available whenever they are needed. No fibers shall leave un-terminated, all fibers must be terminated. A document with fiber cable test results for every fiber cable link shall be provided by the Contractor.

The Contractor shall observe the manufacturer's specifications for maximum tension and minimum bend radius for each fiber optic cable. The contractor shall provide a copy of the manufacturer's specifications to the owner prior to the commencement of the work.

Care must be taken when mechanical pulling devices are used, that maximum tension limits are not exceeded. Minimum bend radius specification shall not be violated when the cables are routed through walls or around corners. The contractor shall ensure that all installation personnel are aware of these limitations.

The Contractor shall follow an intelligent numbering system based upon the destination and channel number. The numbering system shall have a prefix 'F' to indicate it is a fiber optic cable, followed by the destination IDF, then a hyphen and the channel within the cable.

100 pairs UTP shall be installed between the Telephone MDF and the Voice/Data MDF. This cable shall be of category 5, 100 MHz and shall be terminated in a rack mounted patch panels installed in the telecommunication closet at the MDF.

Multi-pair, CAT 5, 100 MHz UTP cable shall be installed as backbone between the voice MDF to the IDF in each floor/location as indicated in the drawings.

Logical labeling should be as per ANSI/TIA/EIA-606. Labels should be ring and printed type. No labels should be written by hand.

## **9. OPTICAL FIBRE CABLE TECHNICAL SPECIFICATION**

Fiber optic cables within the premises shall use multimode, graded-index.

Fibers must comply with EIA/TIA 492 specifications and OM3 fiber specification as in IS 11801 standard.

Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges. All fibers shall be color coded to facilitate individual fiber identification. The coating shall be mechanically strippable.

Core	50 $\mu\text{m} \pm 3 \mu\text{m}$
Core Non-Circularity:	<6%
Core/Cladding Con Error:	<3.0 $\mu\text{m}$
Numerical Aperture:	0.200 $\pm$ 0.015
Cladding diameter:	125 $\mu\text{m} \pm 1 \mu\text{m}$
Cladding Non-Circularity:	<2.0%
Colored Fiber Diameter:	250 $\mu\text{m} \pm 15 \mu\text{m}$
Buffering Diameter:	890 mm $\pm$ 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending:	.75 in. (1.91 cm)
Cable Minimum Bending During Installation: After Installation:	20 times cable diameter 10 times cable diameter

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.5 dB/km at 850 NM 1.5 dB/km at 1300 NM
Minimum Bandwidth:	1500 MHz km at 850 nm (OFL) 500 MHz .km at 1300 nm (OFL) 2000 MHz km at 850 nm (DMD, laser) 500 MHz km at 1300 nm (DMD, laser)

## 10. DATA & VOICE OUTLETS

The Contractor shall provide the identification labels at each and every information outlet with clear information of its connection. (TR, cabinet number, patch panel number and port number). The labeling shall be on the faceplate of the information outlet according to EIA/TIA 606 Administration Standard.

The contractor has to provide clear identification labels for data & voice.

In the process of installing the information outlets, if the Contractor envisages difficulty in mounting the outlet at planned location in the drawings. The contractor shall notify the Engineer/Owner, the contractor shall not make his own discretion in modifying or changing any information provided in the drawings.



The type of information outlets shall be of modular RJ45 of Matt Chrome/ metallic or any other approved finish, 8 position, 8 conductor designed for high speed networking applications that use data transmission rates over frequency ranges up to and potentially beyond 250 MHz & 100MHz. The outlets shall be of insulation displacement connectors type (IDC).

The 8 position/8 conductor outlet shall meet the category 6 transmission requirements for connecting hardware specified in ISO/IEC 11801 and EIA/TIA-568A/B and Class E design guidelines.

The modular outlet shall provide maximum versatility in designing a premise distribution system. It shall be designed to snap into modular faceplate. When the outlet is inserted into the faceplate or frame, it shall lock into place and shall only be released using the dual-purpose wire insertion tool. The mounting and removal system shall allow easy installation and modification. The faceplate jacks must be shutter protected and shall include a label window required to write circuit identification number. Each port must support a color icon to identify the port function. The plastic used to construct the modular data outlet shall be of high impact, flame-retardant, made of poly(phenylene oxide) with flammability rating meeting UL 94V-0UL, the jack wires shall be at least 50 micro-inch lubricated gold plating over 100 micro-inch nickel under plate. The connector shall be of copper alloy, at least 100 micro-inch bright solder over 100 micro-inch nickel under plate.

The insulation displacement connector shall accept 24/23 AWG solid copper wire conductors. The connector shall have multicolor labels marking wire terminals with numbers, assuring fast, accurate installation. The outlet must support wiring configuration as per T568A and T568B on the same RJ-45 jack

The connector shall be wired using the wire insertion tool (impact tool). The module shall be wired from the centre to the outside and shall not untwist paired conductors more than 12.7 mm. In the process of terminating the cables in patch panels/outlets the Contractor shall ensure ISO/IEC and TIA/EIA category 5E/6 transmission performance requirements.

## **11. PATCH CORDS**

The contractor shall supply patch cords for all the installed points on the network switch side as well on the workstation side. The cord length shall be of two different sizes, 1m on the network switches side and 3m on the workstation side.

The patch cable shall meet the requirements warranted to meet ISO/IEC 11801, EN 50173 and EIA/TIA 568A/B category 6 wiring standards capable of connecting high speed information terminal devices to information outlets, to interconnect information terminal devices and 8-

position modular jack panel applications. The patch cord shall be designed to provide support for extended multimedia transmission distance over frequency ranges up to and potentially beyond 100/250MHz.

The patch cord shall support the computer networking applications over frequency ranges up to and potentially beyond 250 MHz and shall be compatible with voice and information applications.

The construction of the cord shall be of stranded type cordage tightly twisted, 24 AWG, 8 conductor. The cord shall be terminated to an 8-position RJ-45 modular plug on both ends. The cords shall support the transmission requirements warranted to meet ISO/IEC 11801 Class E, EN 50173 or TIA/EIA 568B Category 6, Class E component specifications and standards.

The Contractor supplied cord shall be of factory crimped modular plug at both ends.

Pre-wired patch cords, 110 to 8 position (RJ45), constructed of 24 gauge, stranded wire in PVC jacket shall be used to add modularity to 110 system.

## **12. PATCH CORD ORGANIZER**

The Contractor shall supply and install sufficient patch cord organizers/inter-bay patch cord organizers that are used for routing patch cords in 19-inch (48.3-cm) frames. The patch cord organizers shall support the requirements of routing patch cords both at the equipment side as well as the Category 6-patch panel cabling side at the wiring closets. These organizers shall be located in the 19-inch frame inside the wiring closet.

The Contractor supplied patch cord organizers/inter-bay patch cord organizers shall support the requirements of routing cords in both horizontal and vertical pathways.

## **13. PATCH PANELS (JACK PANELS)**

The Contractor shall supply and install the modular patch panels to meet the full cabling system requirement of the "building/complex". Every category 6 cables serving the information outlets at work areas shall be terminated at the patch panels. The Contractor shall ensure that the supplied patch panels meet the ISO/IEC 11801, EN 50173 and TIA/EIA 568 warranted component specifications and standards.

The patch panels shall be of 19-inch rack-mounted panels. The rear of the panel shall feature connecting blocks mounted on a printed wiring board. These connecting blocks shall be capable for use in terminating category 6 station wires, equipment, or tie cables. The modular patch

panel shall be capable of supporting up to 24 jack positions (ports) as required by the design drawings of the voice and data system and shall have the facility to write the circuit designation details at the front side of each jack. The contractor shall provide 20% spare capacity for both voice and data.

The insulating displacement connector field in the patch panel shall be made continuous to the 8-pin modular jack field on front of the panel through printed wiring board connections to enhance the features to confirm to EIA/TIA 568A/B cabling recommendations.

The construction of the modular jack panel shall be of category 6 – compliant and shall have the stringent requirements of connecting hardware as specified in EIA/TIA 568A/B commercial/residential building Cabling System standards.

When the patch panels are tested in accordance with the appropriate test methods described in EIA/TIA 568 A/B and ISO/IEC 11801, EN 50173 Category 6 specifications. The modular patch panels shall meet the worst-pair near-end cross talk (NEXT) requirements over the entire frequency ranges up to and potentially beyond 100/250 MHz on all pair combinations.

Care must be taken to ensure that the cables are terminated correctly at category 6 cross connect hardware (patch panels).

The pair twist of the cables must be maintained as close to the termination at the patch panel IDC Modular outlet as possible. Cables shall not be untwisted for more than 12.7 mm. The cable conductor's entry shall be at the center of the IDC module and the module shall be wired from the center to the outside.

The cable conductors shall be terminated as described in EIA/TIA 568A/B and ISO/IEC 11801, EN 50173 Category 6, Class E wiring sequence by using the proper insertion tool (impact tool).

When terminating the cables in the insulating displacement connector field, care must be taken to ensure that the strip – back is limited only as much cable jacket as is required to perform connecting hardware terminations. The cables shall be properly secure terminations. The cables shall be properly secured to the 19 – inch rack with cable ties as well as at the patch panels.

The IDC connectors must be color coded to meet both T568A and T568B wiring Configuration.

Each port of the patch panel must support color Icon to identify the port function.

Each port must be numbered in sequence with white printing on black background or other high contrast colors.

Each port on the patch panel must have a label place holder and for the patch panel number.

The IDC connector on the back of the patch panel shall support 22 to 25 AWG solid conductors cables.

The package must include frame mounting screws, labels, cable ties and instruction sheet.

#### **14. IDC WIRING SYSTEM**

The IDC blocks shall be used for the voice cross connect and should be 19" rack mountable type.

The IDC blocks shall be capable of terminating up to 336 pairs.

Shall be capable to terminate 22-26 AWG solid conductors or 22-26 AWG stranded conductors.

Shall be made of high-impact UL 94V-0 rated thermoplastic.

Maximum insulated conductor outside diameter 0.05"

Complete kit include connecting blocks, labels and label holders shall be used.

Jumper troughs shall be used to route cable horizontally and vertically.

#### **15. CABLING CABINET (Racks)**

The Contractor shall supply and install cabling System Cabinets to house the passive and active network equipment. The cabinets shall be free/standing or wall mounting types.

The Cabling System cabinets shall meet the requirements of accommodating the high volume of cabling 19" 24-port patch panels & LAN Equipment fully assembled with the following items.(Cabinet dimension 42U 600 mm x 800 mm nominal width & depth). The cabinets must meet the following specifications:

42U 800 x 800 Ready Rack

500 KG load rating

42U 600 4mm Safety Glass Door (On the front).

42U 600 1.6 mm steel Door (On the rear).

600 x 800 side vented top cover.

Castors heavy duty braked.

42U Panel mounting angle kit.

800 X 800 thermostat controlled Low Noise Fan Tray.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light with mounting brackets. The AC Mains distribution integral at

the rear pillar of the cabinet should have at least 10 of 13 amp. Power Outlets. Cable management panel inclusive of other accessories such as earthling kits, screws, washers, grip-nuts and a removable shelf, able to resist a weight of 50 to 60 kgs. The cabinets shall be rugged and strong and all steel shall be finished scratch proof in a durable enamel Grey paint on both sides.

The cabinets must include Low Noise Thermostat controlled fans and shall automatically switch on and off according to the temperature inside the cabinets, the temperature range shall be from 10 to 60 degrees centigrade. The dimensions of the tray shall be of 600 mm x 800 mm. The fan tray shall have minimum of four fans 250 Volts AC + 6% 50 Hz. The low noise top mounted fan tray shall aid the cooling requirement of the LAN equipment installed inside the cabinets, and in the process of installing the fan tray on top of the cabinet it shall not occupy any of the usable U height in the cabinet.

The front glass door shall have at least 4 mm toughened & 50 percent light transmission smoked safety glass able to resist a weight of 80 to 100 Kgs. Placed within 200 mm of the door center. The door shall be lockable and shall have a swing handle supplied with 2 keys.

The rear door shall be the same as the front except the construction of the door shall be of rugged and strong 1.6mm steel finished in a durable enamel Grey paint on both sides, and without glass.

The internal panel mounting angles shall be supplied in pairs to provide 19" mounting positions with hole patterns to accept captive nuts on universal centers. In the design of the panel mounts the centers of each U height shall be notched, to make the positioning of cage nuts much simpler. The panel mounting shall be fitted onto panel mount angle supports to allow infinite adjustment throughout the depth of the track.

The cabinets shall be supplied at least with one shelf kit. The shelf should carry a load rating of 50 Kgs. And shall be manufactured with holes/slots providing sufficient airflow to LAN equipment when installed inside the cabinets.

Four steel castors with rubber wheels at least 40 mm high. These castors shall be mounted at the corners of the cabinet and be able to support the total weight of the cabinet and all options.

The cabinets must support the installation of fire protection units and all 19" equipment including frames for 110-punch block.

The supplied cabinets must meet the following standards:

IEC 297-2

D/N 4/494 Part 7

D/N 4/491 Part 1  
Load rating 500 Kg  
Rust proof coating  
EN 60950  
VDE 0100  
Material 1.6mm steel  
Paint finish according to RAL 7035

For the 25U freestanding cabinets the specifications is as follows:

The 19" 6U, 350 x 600, rack mounted type. Tempered glass front & rear door with key lock for maximum protection.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light. The AC Mains distribution Integral at the rear pillar of the cabinet should have at least 6 of 13 amp. Power Outlets.

The cabinet shall be fitted with at least a 2 way low Noise Fan Tray and medium duty castors.

The supplied cabinets must meet the following standards:

IEC 297-2

D/N 4/494 Part 7

D/N 4/491 Part 1

Load rating 500 Kg

Rust proof coating

EN 60950

VDE 0100

Material 1.6mm steel

Paint finish according to RAL 7035

18 42 U free standing open frame

Integrated cable and cord management

allows for more efficient and effective cable management

Focused on accessibility

Extruded aluminum construction

Modular open frame design (no doors and side panels to remove)

Pre-threaded mounting holes

42U with 270 holes per vertical channel meets EIA/TIA RMU rack mounting unit dimension

Mounting screws with pilot point

Cable guides provide an effortless solution to transitioning cables

Flexible cable guides allow cable to snap-in easily for quick cable routing

Spacing of cable guides aligns exactly with the standard ISO 1101 rack

Unique switch gate Door / Cover provides easy access to the door  
Edge protected pass through holes for transition of cables to rear side

Atif Nazar (Pvt.) Ltd.

## **SECTION - N**

### **ADDRESSABLE FIRE ALARM SYSTEM**

#### **1. SCOPE**

The work consists of supply, installation and commissioning of all material and services of the complete Addressable Fire Alarm system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

#### **2. STANDARDS**

Following standards/codes shall be applicable:

BS 5839

NFPA 72

Any other international standard

#### **3. OPERATION**

The Fire Alarm System shall be pre-signal non-coded type complete with battery backup.

As per drawings the break glass type fire alarm stations and automatic detectors shall be installed at site. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking the glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

Circuit shall be so arranged that an open circuit in an initiating or indicating loop shall cause the individual zone and common trouble indication at the fire alarm control panel.

#### **4.0 MATERIAL**



**4.1 Wiring**

Fire Alarm Cable shall be 2 core shielded twisted pair, fire resistant, PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit.

**4.2 Power Supply**

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure. A 20 Amp SPN switch socket shall be provided near the central fire alarm panel to feed the mains supply.

**4.3 Fire Alarm Control and Indication Unit**

The fire alarm control and indication unit shall be a Solid State Modular Unit consisting of the following Modules; suitable number of modules shall be used to provide facility for 6 loops. It shall not be possible to remove the key without turning the key to its normal position, thus resetting the alarm contacts.

**i. Loop Module**

loop Module shall have multiple of supervised initiating circuit with a trouble and an Alarm Lamp for each loop. Detection circuit wiring shall be two wire Class 'A' and shall power all Detectors (Relay outputs and) voltage output for each zone alarm and voltage output for each zone trouble shall be provided.

**ii. Audible Expander Modules**

Audible Expander Modules shall provide for supervised control circuit for polarized alarm signaling devices. Loop activated lamp shall be provided for each loop to aid on system testing and trouble- shooting provide (1) (2) (3) indicating circuits.

**iii. Power Module**

Power Module shall supply the necessary power for the loop module and all Detectors (and shall contain a Battery Charger to charge the batteries) An AC power to Lamp shall be provided to indicate the normal condition of the panel. Individual supervisory lamps shall be provided for AC power failure indication, ground fault detection, and low battery. All controls shall be behind a key locked door to prevent unauthorized operation. Two supervised control circuits for audible signaling shall be provided as part of this module. Common trouble and common alarm relay and logic outputs shall be provided. The panel cover shall be key locked to prevent unauthorized access.

**4.4 Manual Call Point**

It shall be re-settable (non-breaking) glass type, electronically addressed and suitable for semi finish and surface amount installation as per drawing. The break-glass manual station shall be operated by pulling down the handle. When operated, the handle shall remain down with the pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

**4.5 Fire Alarm Bell**

Fire alarm (bell) shall be of red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors.

**4.6 Smoke Detector**

The detector shall use the light scattering principal to measure smoke density & shall send data to FACP indicating analog level of smoke density. It should be low profile design, electronically addressed, twin LED's for 360 degree vision and removable optical chamber for cleaning & maintenance. The operating voltage shall be 24V DC and surface mounted ceiling and shall include a separate twist-lock base that includes a temper proof feature.

**4.7 Heat Detector**

It should be low profile design with fixed temperature and rate of rise heat detection type. The heat detector shall be intelligent addressable device rated for 135 degrees. Electronically addressed and twin LED's for 360 degree vision. The operating voltage shall be 24V DC and surface mounted as per drawing.

**4.8 Fire Alarm Sounder**

It shall be of red color surface mounted installed as per drawing. It should be electronically addressed and strobe provided by high intensity LED cluster. The operating voltage shall be 24V DC.

**4.9 Annunciator**

The remote visual annunciator shall have the capacity for indicating 6 distinct alarm loop and one common trouble condition. The annunciator shall be back lighted type to increase visibility and to deter tampering with the lamps. The descriptions of each zone shall be approved by the Engineer In-charge. In the normal condition the annunciator shall have a blank appearance. Alarm and trouble condition shall be annunciated both visually and audibly. Lamp shall be 24 V DC, and replacement shall be readily available. Lamp replacements shall be accomplished without tools.

A test switch shall be provided for periodic testing of all lamps in the annunciator. To

reduce tampering the annunciator shall have a key operated silence switch and a key locked cover. For aesthetic reasons the unit shall be compact, have a brushed metallic trim ring and be surface mounted.

#### **4.10 Function of Addressable Fire Alarm Control Panel (FACP)**

##### **i. Design**

The FACP shall be solid state, modular design with integral static protection. All indicating lamps shall be long life, low maintenance solid state light emitting diodes (LED). It shall have graphically LCD display, programmable from PC built-in gas extinguishing control and integrated security alarm facilities. It should be designed to receive signals emitted by manual call points & fire detectors, producing sound & light indications. It should provide options for integration of external sound units & executive devices.

##### **ii. Enclosure**

The FACP enclosure shall be semi flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

##### **iii. Loops & Identification**

All controls shall be labeled, all loop locations shall be identified, and the FACP shall be provided with a set of permanently mounted operating instructions, to avoid confusion. Loop location identification shall be as approved by the Engineer In-charge and contain up to three lines of text with 1/8" minimum character heights.

##### **iv. Components of Fire Alarm Control Panel**

- a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery backed RAM. Removal of the board shall not cause loss of memory contents.

Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

- b. Indicating zones: As indicated on the drawings, each zone containing smoke detectors shall provide power and monitoring for up to only 50% detectors. (All hardware and software shall be provided to facilitate selection of circuit performance to provide alarm verification for smoke detector circuits with field false alarms. When a detector signals an alarm, the panel shall automatically reset the detector, wait and their double checks to verify the alarm. Each zone shall have a red LED to indicate alarm and yellow or amber LED to indicate a trouble condition.
- c. Indicating Loops: 1 or 2 indicating circuits shall be provided. Each circuit shall provide power for polarized alarm signaling devices. A red LED to indicate the energized state of the circuit and a yellow LED to indicate a trouble condition shall be provided for each circuit. A disconnect switch for each circuit shall be provided to allow the FACP to be tested with sounding alarm signals. When disconnected, the FACP shall indicate both trouble condition and disconnect.

**v. Manual Functions**

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the

condition on any zone.

**vi. System Supervision**

- a. Upon application of primary power, or reapplication following power failure, the FACP shall automatically be in a normal supervisory condition.
- b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.
- c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.
- d. The following shall be electrically supervised:

All initiating and indicating device circuits.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

**4.11 Test**

Upon completion, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

**4.12 Installation**

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer In-charge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The Fire alarm system conduit shall be laid 15cms (6") from the electrical conduits and cross the

electrical conduit at 90 degree only. The Fire alarm system conduit shall be marked with red color at terminations in order to distinguish it from other conduit system.

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## **SECTION - O**

### **CONVENTIONAL FIRE ALARM SYSTEM**

#### **1. SCOPE**

The work consists of supply, installation and commissioning of all material and services of the complete Addressable Fire Alarm system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

#### **2. STANDARDS**

Following standards/codes shall be applicable:

BS 5839

NFPA 72

Any other international standard

#### **3. OPERATION**

The Fire Alarm System shall be pre-signal non-coded type complete with battery backup.

As per drawings the break glass type fire alarm stations and automatic detectors shall be installed at site. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking the glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

#### **4. MATERIAL**

##### **4.1 Wiring**

Fire Alarm Cable shall be 2core, fire resistant, PVC/PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit.

#### **4.2 Power Supply**

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure. A 20 Amp SPN switch socket shall be provided near the central fire alarm panel to feed the mains supply.

#### **4.4 Manual Call Point**

It shall be re-settable (non-breaking) glass type, electronically addressed and suitable for semi finish and surface amount installation as per drawing. The break-glass manual station shall be operated by pulling down the handle. When operated, the handle shall remain down with the pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

#### **4.5 Fire Alarm Bell**

Fire alarm (bell) shall be of red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors.

#### **4.6 Smoke Detector**

The detector shall use the light scattering principal to measure smoke density & shall send data to FACP indicating analog level of smoke density. It should be low profile design, electronically addressed, twin LED's for 360 degree vision and removable optical chamber for cleaning & maintenance. The operating voltage shall be 24V DC and surface mounted ceiling and shall include a separate twist-lock base that includes a temper proof feature.

#### **4.7 Heat Detector**

It should be low profile design with fixed temperature and rate of rise heat detection type. Electronically addressed and twin LED's for 360 degree vision. The operating voltage shall be 24V DC and surface mounted as per drawing.

#### **4.8 Fire Alarm Sounder**

It shall be of red color surface mounted installed as per drawing. It should be electronically addressed and strobe provided by high intensity LED cluster. The operating voltage shall be 24V DC.

#### **4.9 Function of Conventional Fire Alarm Control Panel (FACP)**



**i. Design**

The FACP shall be solid state, modular design highly reliable & functional type with integral static protection. All indicating lamps shall be long life, low maintenance solid state light emitting diodes (LED). It shall have graphically LCD display, programmable from PC built-in gas extinguishing control and integrated security alarm facilities. It should be designed to receive signals emitted by manual call points & fire detectors, producing sound & light indications. It should provide options for integration of external sound units & executive devices.

**ii. Enclosure**

The FACP enclosure shall be semi flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

**iii. Functions**

The functions of conventional fire alarm systems shall be as follows:

- a. Control over fire alarm lines & controllable output for fault conditions (short circuit & interruption) and automatic reset.
- b. Detection of removed fire detector and automatic reset.
- c. Ability to identify automatic fire detectors and manual call points.
- d. LED indication for fire & fault conditions.
- e. Built-in sound signalization for fire condition (one-tonal continuous) that can be switched off.
- f. Built-in sound signalization for fault condition (one-tonal continuous) that can be switched off.
- g. Test mode of fire alarm lines.
- h. Disable of fire alarm lines.
- i. Disable of output for fire condition.

**iv. Components of Fire Alarm Control Panel**

- a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery backed RAM. Removal of the board shall not cause loss of memory contents.

Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

- b. Indicating zones: As indicated on the drawings, each zone containing smoke detectors shall provide power and monitoring for up to only 50% detectors. (All hardware and software shall be provided to facilitate selection of circuit performance to provide alarm verification for smoke detector circuits with field false alarms. When a detector signals an alarm, the panel shall automatically reset the detector, wait and their double checks to verify the alarm. Each zone shall have a red LED to indicate alarm and yellow or amber LED to indicate a trouble condition.

**v. Manual Functions**

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

**vi. System Supervision**

- a. Upon application of primary power, or reapplication following power

failure, the FACP shall automatically be in a normal supervisory condition.

- b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.
- c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.
- d. The following shall be electrically supervised:

All initiating and indicating device circuits.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

#### **4.11 Test**

Upon completion, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

#### **4.12 Installation**

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer In-charge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The Fire alarm system conduit shall be laid 15cms (6") from the electrical conduits and cross the electrical conduit at 90 degree only. The Fire alarm system conduit shall be marked with red color at terminations in order to distinguish it from other conduit system.

## **SECTION – P**

### **CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM**

#### **1. GENERAL**

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll-free, 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.
- D. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non warranty items.

#### **2. GENERAL SPECIFICATIONS**

##### **Indoor/Outdoor CCTV Camera Dome System**

- A. The indoor/outdoor CCTV camera dome system shall be a discreet, miniature camera dome system consisting of a dome drive with a variable speed/high speed pan and tilt drive unit with continuous 360° rotation, 1/4-inch high resolution color (or monochrome or color/black-white) CCD camera, motorized zoom lens with optical and digital zoom and auto focus; and an enclosure consisting of a back box, lower dome, and a quick-install mounting.
- B. The indoor/outdoor CCTV camera dome system shall meet or exceed the following design and performance specifications:

#### **3. DOME DRIVE**

- A. The variable speed/high speed pan and tilt drive unit shall meet or exceed the following design and performance specifications:
  - 1. Pan Speed Variable between 360° per second continuous pan to 0.1° per second

2.	Vertical Tilt	Unobstructed tilt of +2° to -92°
3.	Manual Control Speed	0.1° to 80° per second, and pan at 150° per second in turbo mode. Tilt operation shall range from 0.1° to 40° per second
4.	Automatic Preset Speed	Pan speed of 360° and a tilt speed of 200° per second
5.	Presets	Eighty preset positions with a 20-character label available for each position; programmable camera settings, including selectable autofocus modes, iris level, LowLight™ limit, and backlight compensation, for each preset; command to copy camera settings from one preset to another; preset programming through control keyboard or through dome system on-screen menu
6.	Preset Accuracy	+/- 0.1°
7.	Proportional Pan / Tilt Speed	Speed decreases in proportion to the increasing depth of zoom
8.	Automatic Power-Up	User-selectable to the mode of operation the dome will assume when power is cycled, including automatically returning to position or function occurring before power outage
9.	Zones	Eight zones with up to 20-character labeling for each, with ability to blank the video in the zone
10.	Motor Drive	Cogged belt with 0.9° stepper motor
11.	Motor Operating Mode	Micro step to 0.015° steps
12.	Motor	Continuous duty, variable speed, operating at 18 to 30 VAC, 24 VAC nominal
13.	Limit Stops	Programmable for manual panning, auto/random scanning, and frame scanning

- |     |                          |   |
|-----|--------------------------|---|
| 14. | Inner Liner              | Rotating black ABS liner inside sealed lower dome   |
| 15. | Alarm Inputs             | Seven N.O./N.C. dry contacts  |
| 16. | Alarm Outputs            | One auxiliary Form C relay output and one open collector auxiliary output   |
| 17. | Alarm Output Programming | Auxiliary outputs can be alternately programmed to operate on alarm   |
| 18. | Alarm Action             | Individually programmed for three priority levels, initiating a stored pattern or going to a pre-assigned preset position   |
| 19. | Resume after Alarm       | After completion of alarm, dome returns to previous programmed state or its previous position   |
| 20. | Window Blanking          | Eight four-sided, user-defined shapes, with each side being of different lengths; window blanking setting to turn off at user-defined zoom ratio; window blanking set to opaque gray or translucent smear; blank all video above user-defined tilt angle; blank all video below user-defined tilt angle |
| 21. | Patterns                 | Four user-defined programmable patterns including pan, tilt, zoom, and preset functions; pattern programming through control keyboard or through dome system on-screen menu   |
| 22. | Pattern Length           | Four patterns of user-defined length, based on dome memory  |
| 23. | Autosensing              | Automatically sense and respond to protocol utilized for controlling unit whether Coaxitron® or RS-422 P or D protocols; accept competitors' control protocols with the use of optional translator cards  |

24.	Menu System	Built-in for setup of programmable functions; multilingual, including English, French, Italian, Spanish, Portuguese, and German, and alternative languages in Russian, Turkish, Polish, and Czechoslovakian
25.	Auto Flip	Rotates dome 180° at bottom of tilt travel
26.	Password Protection	Programmable settings with optional password protection
27.	Clear	Clear individual, grouped, or all programmed settings
28.	Diagnostics	On-screen diagnostic system information
29.	Freeze Frame	Freeze current scene of video during preset movement
30.	Display Setup	User-definable locations of all labels and displays; user-selectable time duration of each display
31.	Azimuth/Elevation / Zoom	On-screen display of pan and tilt locations and zoom ratio
32.	Compass Display	On-screen display of compass heading; user-definable compass setup
33.	Video Output Level	User-selectable: normal, or high to compensate for long video wire runs
34.	Dome Drive Compatibility	All dome drives are compatible with all back box configurations
35.	RJ-45 Jack	Plug-in jack on dome drive for control and setup of unit and for uploading new operating code and language file updates. Compatible with personal computers and PDAs such as Palm and iPAQ
36.	Remote Data Port Compatibility	Ability to control and setup unit and to upload new operating code and language file updates

		through optional remote data port that is located in area with easy access. Compatible with personal computers and PDAs such as Palm and iPAQ
37.	UTP Compatibility	Ability to plug into back box an optional board that converts video output to passive, unshielded twisted pair transmission
38.	Fiber Optic Compatibility	Ability to plug into back box an optional third-party board that converts video output and control input to fiber optic transmission
39.	Third-Party Control Systems	Ability to plug in optional board that converts control signals from selected third-party controllers
40.	Power Consumption	Maximum 70 VA

#### **4. BACK BOX AND LOWER DOME**

The back box and lower dome shall meet or exceed the following design and performance specifications:

##### **A. In-Ceiling Environmental**

1.	Connection to Dome Drive	Quick, positive mechanical and electrical disconnect without the use of any tools
2.	Trap Door	Easy-access trap door that allows complete access to the installation wiring and, when closed, provides complete separation of the wiring from the dome drive mechanics
3.	Terminal Strips	Removable terminal strips with screw-type terminals for use with a wide range of wire gauge sizes
4.	Auxiliary Connections	One Form-C relay output at <40 V, 2 A maximum, and a second open collector output at 32 VDC maximum at 150 mA
5.	Alarm Inputs	Seven alarm inputs



- |     |                        |  |
|-----|------------------------|--|
| 6.  | Installation           | Quick-mount spring clips   |
| 7.  | Cable Entry            | Through a 0.75-inch conduit hole   |
| 8.  | Environmental Features | Factory-installed heaters and blowers  |
| 9.  | Operating Temperatures | Maximum temperature range of -60° to 140°F (-51.1° to 60°C) for two hours, and a continuous operating range of -50° to 122°F (-51.1° to 50°C) continuous operation   |
| 10. | Memory                 | Built-in memory storage of camera and location-specific dome settings such as presets and patterns. If new dome drive is installed in back box, all settings to download automatically into new dome drive |
| 11. | Color                  | Black, baked-on enamel powder coat   |
| 12. | Construction           | Aluminum   |
| 13. | Lower Dome Material    | Acrylic, optically clear, with no distortion in any portion of the dome up to +2° above the horizontal   |
| 14. | Dome Color             | Clear and smoked versions  |
| 15. | Trim Ring Connection   | Two captivated screws  |

**B. In-Ceiling Interior**

- |    |                          |   |
|----|--------------------------|---|
| 1. | Connection to Dome Drive | Quick, positive mechanical and electrical disconnect without the use of any tools   |
| 2. | Trap Door                | Easy-access trap door that allows complete access to the installation wiring and, when closed, provides complete separation of the wiring from the dome drive mechanics |
| 3. | Terminal Strips          | Removable terminal strips with screw-type terminals for use with a wide range of wire gauge sizes   |

- |     |                        |  |
|-----|------------------------|--|
| 4.  | Auxiliary Connections  | One Form-C relay output at <40 V, 2 A maximum, and a second open collector output at 32 VDC maximum at 150 mA  |
| 5.  | Alarm Inputs           | Seven alarm inputs   |
| 6.  | Installation           | Quick-mount spring clips   |
| 7.  | Cable Entry            | Through a 0.75-inch conduit hole   |
| 8.  | Operating Temperatures | Maximum temperature range of 32° to 122°F (0° to 50°C)   |
| 9.  | Memory                 | Built-in memory storage of camera and location-specific dome settings such as presets and patterns. If new dome drive is installed in back box, all settings to download automatically into new dome drive |
| 10. | Color                  | Black back box, baked-on enamel powder coat; white trim ring   |
| 11. | Construction           | Aluminum   |
| 12. | Lower Dome Material    | Acrylic, optically clear, with no distortion in any portion of the dome up to +2° above the horizontal   |
| 13. | Dome Color             | Clear, smoked, chrome, and gold versions   |
| 14. | Trim Ring Connection   | Snap in place  |
| 15. | Safety Cable           | Plastic tether   |

## **5. DIGITAL VIDEO RECORDER**

- A. The digital video recorder (DVR) shall provide a high-quality recorder capable of storage and playback of images from 1 to 16 camera inputs at a simultaneous refreshing recording rate of up to 480 images per second (NTSC) at CIF resolution with a CD-RW as standard equipment. Refer to paragraph B.8. for total frame rates at 2 CIF and 4 CIF resolutions. The DVR shall possess a watchdog system, triplex operation, Windows® 2000 operating system with Service Pack 4 with the latest security updates from Microsoft, watermarking of each frame, inputs for external alarms, video motion

detection, and scheduled event recording. Remote software shall be provided for operation via PC, web, and Pocket PC handheld devices.

B. The DVR shall meet or exceed the following design and performance specifications:

**PROCESSOR:**

1. Processing Unit: Pentium® 4, 2.8 GHz processor with 256 MB of RAM
2. Recording Modes: Continuous, motion detection, alarm activation, or scheduled recording
3. Storage: Hard drive with 80, 250, 500, 750, or 1,000 GB of storage
4. Operating Software: Windows 2000, Service Pack 4
5. Signal Format: NTSC/PAL
6. Resolution:
 

NTSC	320 x 240, 640 x 240, 640 x 480, 720 x 240, or 720 x 480 pixels, depending on model
PAL	352 x 288, 704 x 288, 704 x 576, 720 x 288, or 720 x 576 pixels, depending on model
7. Compression: Pelco proprietary
 

Frame Rate:	NTSC	PAL	
	CIF	480 ips	400 ips
	2CIF	112 ips	96 ips
	4CIF	80 ips	64 ips
8. Functions: Operate as a recorder and a full-duplex multiplexer
9. PTZ Control: Pan, tilt, and zoom functions via RS-422 communications (D, P, and Coaxitron® protocols)
10. Viewing / Recording: Configurations of full screen, 4, 9, 12, or 16 cameras, or custom-designed display views
11. Full-Triplex

- Operation: Simultaneous playback and live viewing while recording live images
12. Programmable Schedules: 24 individual schedules
13. Program Modes: Motion event, alarm input, or continuous recording
14. Hardware Watchdog System: A hardware device to monitor the system clock for Windows lockup; upon lockup of the system the recorder shall automatically reboot without losing any of the programmed settings
15. Password Protection: Four user levels of protection for setup functions, operation, and system exiting
16. Motion Detection: Built-in motion detection for each camera to start recording or to increase the recording rate of the system
17. Motion Areas: Selectable detection area and sensitivity for each camera
18. Alarm/Motion Activation: Alarm input will start the unit recording, or if already recording, increase the recording rate and image quality
19. Pre-Alarm or Pre-Motion Recording: Record images for up to 60 seconds before the alarm sensor has been activated
20. Bandwidth Throttling: Network throttling of transmitted video
21. Alarm History Log: Available through a query
22. Alarm Outputs: Sixteen dry contact alarm outputs to activate external devices
23. Motion Activation: When a unit is in scheduled time recording and a camera detects motion or an alarm is activated, the system shall begin recording the event
24. Remote Control: Full remote control operation of pan, tilt, and zoom

functions via TCP/IP protocol and RS-422 interface

25. LAN/WAN

Connection: Software and hardware provided for viewing and controlling DVR over the network

26. Video Quality: High-quality video recording of at least VHS grade compared to the original video; supports NTSC or PAL video

27. Color Palettes: Minimum of 16 million color palettes

28. Gray Scale: 256 shades

29. Backup: A backup management system is to be provided to back up data to external devices (CD or other storage devices) without interrupting hard disk recording

30. Hard Disk Drives: From 80 GB up to 1TB

31. Programming: On-screen programming and operation through a PC keyboard or PS/2 mouse.

32. Digital Zoom: Digital zoom of the image on the screen during playback modes

33. Authentication: Software provided for image verification of each image recorded

**MECHANICAL:**

Mounting: Capable of being mounted in an EIA-standard 19-inch rack or placed on a shelf or desktop  
Connectors:

- a. Depending on model, eight or sixteen BNC video inputs plus eight or sixteen looping video outputs with automatic termination
- b. Two 9-pin, D-type connectors for COM 1 and COM 2 ports (disabled)
- c. Two 6-pin, mini-DIN connectors for a PS/2 mouse and keyboard
- d. One 15-pin, D-type port for a PC monitor connection
- e. One 25-pin D-type port for Printer connection
- f. One S-video jack for analog monitor output (disabled)
- g. Two multiplexed analog video outputs (optional)
- h. One RJ-45 connector for network connection
- i. Four RJ-45 ports for RS485/RS422 support

- j. Depending on model, eight or sixteen push-in connectors for alarm inputs and eight or sixteen push-in connectors for relay outputs
- k. Six high-speed USB 2.0 ports

Dimensions:

- a. Desk Mount  
7.0 (H) x 17 (W) x 19.9 (D) inches  
(17.78 x 43.18 x 50.55 cm)
- b. Rack Mount  
7.0 (H) x 19.0 (W) x 22.0 (D) inches  
(17.78 x 48.26 x 55.88 cm)

Operating Temperature: 50°F to 95°F (10° to 35°C)

Relative Humidity: Maximum 80% non condensing

Optical Drive: CD-RW

**ELECTRICAL:**

Input Voltage 100-240 VAC, 50/60Hz, auto ranging

**7. GENERAL SPECIFICATIONS**

- A. The DSP color CCTV camera shall consist of a 1/3-inch format CCD imaging chip.
- B. The DSP color CCTV camera shall meet or exceed the following design and performance specifications:

**8. VARI-FOCAL LENGTH, DC-DRIVE, AUTO IRIS LENS**

The lens shall be a 1/3" format, variable focal length, auto iris lens, along with any accessories that may be required for a complete lens system.

The lens shall meet or exceed the following design and performance specifications:

The lens shall be a "CS" mount.

The lens shall be used with 1/3" or smaller format cameras.

The lens shall provide DC-drive auto iris, manual zoom and manual focus adjustments.

The lens shall provide high resolution optics in a compact body.

The lens shall automatically compensate for changing light conditions utilizing DC-drive voltages

from the amplifier circuitry resident in the camera.

The lens shall be equipped with a 4-pin “square” connector for auto iris functions.

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## **SECTION – Q**

### **PUBLIC ADDRESS/SOUND SYSTEM**

#### **1. SUMMARY**

This section includes supply and installation of equipments for amplifying, distributing, and reproducing sound signals.

#### **2. GENERAL**

A complete sound system is required for project and shall consists of an amplifiers, loud speakers, microphone, outlets on walls and the necessary wiring etc. The Contractor is required to supply and install complete sound system equipment, surface/concealed P.V.C conduit wiring etc. as specified herein or otherwise required for proper functioning and on drawings, the Contractor shall submit detailed shop drawings of the sound system offered by them, for final approval and acceptance of the consultants.

#### **3. AMPLIFIER**

The amplifier shall consist of a preamplifier unit and 25 watts power amplifier. The unit shall be fully transistorized and modular type so that by sliding different components and clip-on connections are made it forms one compact unit.

The preamplifier shall have two microphones inputs and shall be suitable to drive at least two amplifiers in parallel or to feed one or more remotely located power amplifier. The preamplifiers should have besides microphone channels at least one music channel for use with record player. The preamplifier shall be completed with master tune control and volume controls as required. The external connections shall be by plugs. The hum and noise level shall be between 44 dB to 62 dB and distortion shall be less than 2% at maximum output.

It shall be suitable to operate on 220 volts 50 c/s single phase circuit. The output voltage made be of manufacturer standard (48-70V). There shall be two loudspeaker output and switching arrangement. The input and output impedance, sensitivity, distortion, hum and noise levels etc. shall be as per manufacturer's standards keeping in view the best performance of the sound system.

#### **4. MICROPHONE**

The microphone shall be unidirectional moving coil type with frequency response range of 40 c/s to 18Kc/s. The impedance shall be 500 Ohms. The microphone shall be provided with metal stand of pleasing appearance having anti-vibration base, adopter, swivel holder, and about 3 meters of microphone cable, built-in plug and switch.



## **5. LOUD SPEAKERS**

The loudspeakers shall be recessed mounting type, 5 watts output having impedance of about 8 Ohms. Frequency range shall be 60-15Kc/s. The loudspeaker shall be of pleasing appearance and it shall be suitable to install on the false ceiling or on the walls as required.

All accessories required for complete sound system and to suit the type of equipment offered shall be supplied and installed by the Contractor. Such accessories shall include switching device, socket outlets for microphone on wall, matching transformer, line transformer, adopter and other installation materials etc. The Contractor shall submit a complete list of accessories for the entire sound system offered by him. The price of such accessories shall be included in the BOQ.

## **6. WIRING**

The wires for loudspeakers outlets wiring shall be twin core P.V.C insulated and screened. The size of wire shall be 2.5mm<sup>2</sup> minimum.

## **7. FUNCTIONAL DESCRIPTION OF SYSTEM**

Delete functions in subparagraphs below that are not required and edit remaining descriptions to suit Project; add other functions as required.

Selectively connecting separate zones to different signal channels.

Selectively amplifying sound among various microphone outlets and other inputs.

Communicating simultaneously to all zones regardless of zone or channel switch settings.

Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.

Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed. Reproducing high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; and output free of non uniform coverage of amplified sound.

## **8. EQUIPMENT AND MATERIALS**

Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

Modular equipment type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

## **9. PREAMPLIFIERS**

It should be either separately mounted or as an integral part of power amplifier.

Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.

Total Harmonic Distortion: Less than 1 percent.

Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.

Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.

Minimum Noise Level: Minus 55 dB below rated output.

Controls: On/off, input levels, and master gain.

## **10. POWER AMPLIFIERS**

Mounting: Rack mounted.

Output Power: 70-W balanced line.

Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

Output Regulation: Less than 2 dB from full to no load.

Controls: On/off, input levels, and low-cut filter.

Input Sensitivity: Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

## **11. COMPONENTS**

Parameters listed in this Article are typical values. Performance and product characteristics vary among manufacturers. Revise to suit Project.

### Microphone:

Type: Dynamic, with cardioids polar or unidirectional characteristic.

Impedance: 150 ohms.

Frequency Response: Uniform, 50 to 14,000 Hz.

Output Level: Minus 58 dB minimum.

Finish: Satin chrome.

Cable: C25J.

Mounting: Desk stand with integral-locking, press-to-talk switch.

Quantity of Microphones: [Four] <Insert number>.

Quantity of Desk Stands: [Three] <Insert number>.

Equipment Rack: For house amplifiers and auxiliary equipment racks should be 19 inches.

Group items of same function together, either vertically or side by side, and arrange controls symmetrically.

Power-Supply Connections: Approved plugs and receptacles.

Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.

Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by

panels.

Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.

Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.

Power-Control Panel: On front of equipment housing, with master power on/off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.

Service Light: At top rear of rack with an adjacent control switch.

Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounted equipment.

Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.

Spare Capacity: [20] <Insert value> percent spare space capacity in rack for future equipment.

Coordinate paragraph and subparagraphs below with Drawings.

Cone-Type Loudspeakers: Comply with TIA/EIA SE-103.

Minimum Axial Sensitivity: Pressure rating of 45 dB.

Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.

Size: 8-inches (200 mm) with 1-inch voice coil and minimum 140grams ceramic magnet.

Minimum Dispersion Angle: 100 degrees.

Rated Output Level: 10 W.

Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.

Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 1.2mm steel and whole assembly rust proofed and shop primed for field painting.

Revise finish description below to suit aesthetic requirements.

Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.

Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.

Conductors and Cables: Jacketed, twisted pair and twisted multi-pair, un-tinned solid copper.

Insulation for Wire in Conduit: Thermoplastic, not less than 0.8mm thick.

Microphone Cables: Neoprene jacketed, not less than 0.8mm thick, over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.

Plenum Cable: Listed and labeled for plenum installation.

## **12. EXECUTION INSTALLATION**

### **Wiring Method**

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in

accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

#### **Wiring within Enclosures**

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

#### **Separation of Wires**

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

#### **Splices, Taps, and Terminations**

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

#### **Identification of Conductors and Cables**

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets: Flush mounted.

Floor-Mounting Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

### **13. EARTHING**

Revise this Article to suit system requirements. Include earthing electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment earthing.

#### **14. FIELD QUALITY CONTROL**

Perform the following field tests and inspections and prepare test reports:

Schedule tests with at least seven days' advance notice of test performance.

After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

##### **Operational Test**

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

Repeat test for each separately controlled zone of loudspeakers.

Minimum acceptance ratio is 50 dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

**15. ADJUSTING**

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

**16. DEMONSTRATION**

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment.

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## **SECTION – R**

### **NURSE CALL SYSTEM**

#### **1. SUMMARY**

This Section includes visual nurse call equipment using lamp and electronic tone annunciation at a central annunciator station to register calls from patient and other call-in stations.

Paragraph below specifies microprocessor-based audiovisual/voice equipment.

This Section includes audiovisual equipment using voice communications and microprocessor control. All stations in an area are connected to a master station. Master stations are capable of communicating selectively with each other and with connected patient and other stations.

#### **2. SUBMITTALS**

Delete items in this Article not required for Project.

Product Data: For each type of product indicated.

Shop Drawings: Detail the system including the following:

Delete inapplicable subparagraphs below.

Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.

Wiring Diagrams: Power, signal, and control wiring.

Station Installation Details: For built-in equipment; dimensioned and to scale.

Equipment Cabinet Drawings: Dimensioned and to scale.

Delete first paragraph below unless Project includes special patient equipment listed.

Coordination Drawings: Detail system components that fit, match, and line up with provisions made in equipment specified in other Sections or in separate contracts:

Delete equipment below not in Project or not applicable to Coordination Drawings.

Patient head-wall units.

Patient consoles.

Patient beds with built-in nurse call features.

Manufacturer Certificates: Signed by manufacturers certifying that nurse call equipment complies with requirements.

Field Tests Reports and Observations: Include record of final adjustments certified by Installer.

Operation and Maintenance Data: For nurse call equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 "[Closeout Procedures] [Operation and Maintenance Data]," include the following:

Operating instructions.

Troubleshooting guide.

Wiring diagrams and terminal identification.

Equipment parts list.

Product data for types and sizes of wires and cables used.

Warranty: Special warranty specified in this Section.

### **3. QUALITY ASSURANCE**

Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

Manufacturer Qualifications: A firm experienced in manufacturing equipment similar to that indicated for this Project and that maintains technical support services capable of providing user with training, parts, and emergency maintenance and repair with a 24-hour-maximum response time.

Source Limitations: Obtain nurse call equipment components through one source from a single manufacturer.

Electrical Components, Devices, and Accessories: Listed and labeled according to UL 1069 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### **4. COORDINATION**

Retain paragraph below if patient control units operate items not part of nurse call equipment.

Coordinate patient control units with items controlled that are not part of nurse call equipment.

Delete inapplicable subparagraphs below.

TV: Channel selection and volume.

Lights: Up light and down light at patient location.

Delete paragraph and subparagraphs below if nurse call equipment is not built into equipment or cabinets.

Coordinate wiring paths and maintenance access at locations listed below. Coordinate trim features and finishes at these locations to present a unified design appearance.

Delete equipment below not in Project. Add others to suit Project.

Patient head-wall units.

Patient consoles.

Patient beds with built-in nurse call features.

Nurse station.

### **5. WARRANTY**

When warranties are required, verify with Owner's counsel that special warranties stated in this Article are not less than remedies available to Owner under prevailing local laws. Coordinate with Division 1 Section "Product Requirements."

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or



replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.

Warranty Period: Include the following warranty periods, from date of Substantial Completion: Retain subparagraph and associated subparagraphs below to match battery type specified in Part 2. Verify availability of warranties with manufacturer.

Nickel-Cadmium, Wet-Cell Batteries:

Full Warranty: [Five] <Insert number> years.

Pro Rata: [15] <Insert number> years.

## **6. EXTRA MATERIALS**

Extra materials may not be allowed for publicly funded projects.

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Revise subparagraph below to suit Project.

Lamps: For corridor dome lights and zone lights equal to [20] <Insert number> percent of amount installed.

Fuses: One for every 10 of each type and rating, but no fewer than <Insert quantity> of each.

Printed Circuit Boards: Each kind, equal to [10] <Insert number> percent of amount installed, but no fewer than one unit.

Retain subparagraph below for audio/visual system only.

Master Station Privacy Handset: [One] <Insert number>.

## **7. SYSTEM REQUIREMENTS**

Coordinate the features of materials and equipment to form an integrated system. Match components and interconnections for optimum performance of specified functions.

Revise percentage in paragraph below to suit Project.

Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 25 percent above those indicated without adding internal or external components or main trunk cable conductors.

Delete first paragraph below if equipment does not connect with an existing system. Add descriptions of specific operational sequences that must be achieved.

Existing System Compatibility: Functionally and electrically compatible with existing system so components and wiring operate as an extension of the existing system and all functional performance of the existing system applies to the final system. Colors, tones, types, and durations of signal manifestation are common between new and existing systems.

Resistance to Electrostatic Discharge: System, components, and cabling, and the selection,

arrangement, and connection of materials and circuits, shall be protected against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.

Equipment: Solid state, modular.

Connection method in paragraph below is optional for some manufacturers.

Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.

## **8. FUNCTIONAL PERFORMANCE**

Retain and edit this Article for visual/tone equipment.

Patient Station Call: Lights a steady call-placed lamp on the station, steady lamps in the zone light and corridor dome light associated with the patient's room, and steady lamps at the central annunciator and master, staff, and duty stations. At the same time, it sounds a distinctive tone at intervals, at the central annunciator and master, staff, and duty stations. Legends at the central annunciator and master station identify the calling station.

Pull-Cord Station Call: Flashes a call-placed lamp on the station and distinctive-color lamps in the zone light and corridor dome light and at the central annunciator and staff and duty stations.

At the same time, it sounds a distinctive tone at intervals, at the central annunciator and master, staff, and duty stations. A legend at the master station identifies the calling station.

Emergency-Call Station Call: Produces the same responses as pull-cord station calls, except flashing and tone repetition rates are more frequent, tone frequency is higher, and lamps in the zone light and corridor dome light are a different color. Indicator lamps may be extinguished and the system reset only at the calling station.

System Reset: Operating reset button at the originating station cancels signals associated with the call.

Cord-Set Removal: A patient station call is initiated when the cord set is removed from the jack in the patient station faceplate. Inserting a cord-set plug or a dummy plug into the jack and operating the station reset button reset the call.

Patient Control Unit: Controls entertainment volume and channel selection. Nurse button on the unit initiates a patient station call. Integral speaker reproduces entertainment sound.

## **9. FUNCTIONAL PERFORMANCE**

Retain and edit this Article for basic audiovisual/voice equipment.

Station Selection: Master station is capable of selectively communicating with other stations or groups of stations on its system by operating selector switches.

Master Station Privacy: Capable of conversing with individual stations in complete privacy.

Hands Free: Called station is capable of conversing hands free.

Annunciation: At the master station, a tone announces an incoming call and an annunciator light or liquid-crystal display identifies the calling station and indicates the priority of the call.

Memory lamps or lighted displays identify stations selected for outgoing calls.

**System Reset at Master Station:** A normal incoming call is canceled, associated lights and audible tones are extinguished, and the system is reset when the station switch is returned to the normal position after responding to a call.

**Patient Station Call:** Lights the call-placed lamp at patient station, zone, and corridor dome lights. It sounds a tone and lights the call lights at staff/duty stations and actuates annunciation at the master station. When the calling station is selected at the master station, the patient can converse with the master station without moving and without raising or directing the voice. During voice communications, entertainment audio at the calling station is automatically muted.

**Pull-Cord Call Station and Emergency-Call Station Call:** Lights call-placed lamp and corridor dome light, and flashes zone light. Master station tone pulses and annunciator light for that room flashes. When master station acknowledges the call by operating a switch, the tone stops but lights continue to flash until the call is canceled at the point of origin.

**Code Blue, Staff, and Duty Station Call:** Lights the call-placed lamp at the station and actuates annunciation at the master station. When the called station is selected at the master station, the caller and the master station operator can converse.

**Code Blue:** Unique sound and light pattern, indicating the highest priority emergency.

**Staff Station:** Unique sound and light pattern, indicating an emergency.

**Duty Station:** Sound and light pattern, indicating a call to the nurse station.

**Handset Operation:** Lifting handset on master station disconnects speaker microphone and transfers conversation to the handset.

**Station Privacy:** No patient, staff, or duty station can be remotely monitored without the lighting of a warning lamp at the monitored station.

**Patient Station Cord Set:** When a patient station cord-set plug is removed from the jack in the station faceplate, a patient station call is initiated as described above. When the master station call button for the station is pressed, the tone stops but lights continue to flash until the call is canceled at the point of origin or the plug is reinserted or replaced with a dummy plug.

**Patient Control Unit:** Controls entertainment volume and channel selection. Speaker is used for both nurse communication and entertainment sound. Entertainment sound is automatically muted when station is communicating with master station. Nurse button on the unit initiates a patient station call.

Three paragraphs below specify optional functions provided in some higher-budget audiovisual/voice equipment. Some functions may be proprietary. Coordinate with Drawings.

**Selective Paging:** Master station is capable of initiating a message to selected groups of stations or speakers simultaneously by using station group switches.

**Staff Reminder:** Master station can initiate a staff reminder that a patient requires direct staff response by operating a reminder control while in contact with the patient station. This will light a distinctive-color lamp in the corridor dome light at the patient's room and in the appropriate zone lights. Reminder calls are canceled by operating a staff reminder cancel switch in the patient's room.

Edit paragraph and subparagraphs below if one method of initiating priority signal is preferred

over another.

Call Priority Indication: Call priority switch near each patient station, or integral with the master station, controls the priority status of the call transmitted by individual stations. The switch selects one of the following status levels:

Normal: No change to the normal call initiation and canceling sequence.

Emergency: Call initiation produces signals and indications identical to those of emergency-call stations. Indicator lamps are extinguished and the system is reset only at the originating station.

Priority: System response is the same for emergency status, except voice communication between the master station and the calling station is locked in from the time of call initiation until the system is reset at the originating station.

Two equipment articles below specify products specific to each of the two alternative equipment types. Retain one to select equipment type. "Miscellaneous Equipment Component Descriptions" Article that follows equipment articles includes products common to both equipment types.

## **10. EQUIPMENT DESCRIPTIONS**

Retain and edit this Article for audiovisual/voice equipment.

Master Station: Speaker-microphone unit with operating controls.

Indicator lamps with legends or by liquid-crystal displays designate identification and priority of calling stations and called stations.

Delete first subparagraph below if call priority option is specified.

Pulse rate of incoming-call lights denotes priority of calls awaiting response.

Station Selection Controls: Switches select stations for two-way voice communications.

Signal Tones: Announce incoming calls.

Delete first subparagraph below if call priority option is specified.

Pulse rate and frequency of tone identify the highest priority call awaiting response at one time.

Volume Control: Regulates incoming-call volume.

Privacy Handset with Hook Switch: Of the type that does not require push-to-talk switch, attached to each station, unless otherwise indicated.

Delete subparagraph below if optional reminder function is not specified.

Staff Reminder Control: Initiates flashing of corresponding corridor dome lights for patients requiring service. Permits scanning equipment to indicate which patients are currently in reminder status.

Delete subparagraph below if individual select ability of patient-call priority indication is not specified or if selection of patient-call priority indication is at room station.

Call Priority Selection: Controls associated with patient station selection switches determine the priority indication displayed when a call is initiated at a patient station.

Central Equipment Cabinet: Lockable metal. Houses amplifiers, tone generators, power supplies, controls, terminal strips, and other components.

Amplifier: With fidelity and overall gain necessary to achieve the sound transmission and reproduction characteristics specified, considering interoperability with the installed

speakers/microphones and wiring.

Power Output: Not less than 3 W at a total harmonic distortion not exceeding 5 percent.

Hum and Noise: 60 dB below full output with normal input open.

Volume Control: Concealed within the amplifier unit to control the volume of sound reproduced at all stations.

Protection: Circuit to prevent damage to the amplifier in case shorted or open output.

Selective Paging Amplifiers: Plug-in card mounted in central equipment cabinet; rated 15 W.

System Power Supply: For 24-V dc for operation of the call system.

Equipment Rating: Suitable for continuous operation between 32 and 120 deg F (0 and 49 deg C), from a primary line voltage between 105- to 125-V ac, 60 Hz.

Output: Regulated 24-V dc with protection against overloads. Line-to-load regulation shall not exceed 2-1/2 percent with ripple and noise remaining below the 10 mV, RMS level.

Overload Protection: Electronic fold-back circuit set to limit the volt-ampere output to less than 100 VA during overloaded or shorted output. Restore power output automatically on removal of overload without resetting circuit breakers or replacing fuses.

Power-on indicator lamp.

Surge Protective Device: Comply with Division 16 Section "Transient Voltage Suppression" for auxiliary panel suppressors, with [LED indicator lights for power and protection status] <Insert accessories>.

Subparagraph and associated subparagraphs below are optional depending on applicable codes and regulations. See Evaluations in Division 16 Section "Central Battery Inverters" for discussion of battery types.

Battery Backup Unit: Sealed [nickel-cadmium, wet-cell] <Insert type> battery supplies power through an automatic switch when normal power fails, for a period of not less than [six] <Insert number> minutes at rated output.

Automatic retransfer to normal power, after a [15] <Insert number>-minute time delay.

Two-rate battery charger with an automatic trickle rate and a recharge rate.

Speaker/Microphones:

Type: Permanent-magnet, dynamic or ceramic, protected against dust and humidity.

Sound Reproduction: Sound level of 90 dB plus or minus 3 dB at a distance of 48 inches (1220 mm) on the axis without overdriving or distorting any frequencies between 300 and 3000 Hz when installed in an enclosure or in the pillow speaker.

Power Handling Capacity: Not susceptible to damage from overdriving within the range of power available from the amplifier.

Impedance Matching: Coordinated and matched to the input and output circuits of the amplifier, both for single connection and for group monitoring, to provide the sound reproduction specified. Subsystems or components shall not be combined, which could cause unacceptable distortion such as feedback between pillow speakers and un-muted room speaker/microphone combinations. This protection shall extend throughout the entire range of operation (volume control) of all components.

Single-Patient Station: Speaker microphone with 2-inch (50-mm) dynamic cone, a polarized receptacle to match the cord-set plug, monitor lamp, reset switch, and call-placed lamp;

assembled under a single faceplate.

Dual-Patient Station: Speaker microphone with 2-inch (50-mm) dynamic cone, two polarized receptacles to match cord-set plugs, monitor lamp, and reset switch; assembled under a single faceplate.

Retain one of two subparagraphs below.

Single call-placed lamp serves both beds.

Dual call-placed lamps, one for each bed.

Staff and Duty Stations: Audible call-tone signal device, speaker microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, routine-call lamp, emergency-call lamp, and call push button; assembled under a single faceplate.

Code Blue Station: Audible call-tone signal device, speaker microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, Code Blue emergency-call lamp, and call push button; assembled under a single faceplate.

Ambulatory-Patient Station: Speaker microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, call-placed lamp, and call push button; assembled under a single faceplate.

Verify adequacy of standard amplifier capacity for Project applications.

Selective Paging Speakers: 8-inch (200-mm) cone type with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet, multi-tap matching transformer, flush-mounting steel back-box, and white enamel-finished metal ceiling grille.

Delete paragraph below if optional call priority indication is not specified.

Call Priority Switch Station: Three-position, tamper-resistant priority selection switch. Positions designated by labeling "Normal," "Emergency," and "Priority."

Delete paragraph below if optional staff reminder function is not specified.

Staff Reminder Cancel Switch Station: Momentary contact.

## **11. MISCELLANEOUS EQUIPMENT COMPONENT DESCRIPTIONS**

Retain and edit this Article for either visual or voice equipment.

Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp; mounted in a single faceplate.

Pull-Cord Call Station: Water-resistant construction. Includes the following, mounted under a single faceplate:

Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."

Reset trigger.

Call-placed lamp.

First six paragraphs and associated subparagraphs below specify plug-in components. Coordinate types and quantities furnished with Owner. Quantities stated are examples only. Verify Owner's sterilization procedures and adjust requirements to suit Project. UL 1069 does not address sterilization.

Patient Control Unit: Equipped with plug and 96-inch- (2400-mm-) long white cord.

Ethylene oxide, sterilize-able.

Delete first subparagraph below if control of room lights is not in patient control units.

Light-Control Switch: Arranged for independent on-off control of patient's up and down light.

Integral Speaker: 2 inches (50 mm), with 0.35-oz. (9.9-g) magnet, rated 0.2 W.

Controls: Speaker volume, TV control, and nurse call.

Housing: High-impact white plastic.

Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.

Quantity: 12 units for every 10 patient beds.

Call-Button Cord Set: Plug and 72-inch (1800-mm) white cord; equipped with momentary-action, call-button switch.

Ethylene oxide, sterilize-able.

Washable cord.

Palladium switch contacts in high-impact white housing with cord-set strain relief.

Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.

Quantity: 3 cord sets for every 10 patient beds.

Geriatric Call-Button Cord Set: Plug and 72-inch (1800-mm) white cord; equipped with momentary-action, light-pressure switch in soft outer jacket.

Ethylene oxide, sterilize-able.

Washable cord.

Palladium switch contacts in high-impact white housing with cord-set strain relief.

Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.

Quantity: 2 cord sets for every 10 patient beds.

Squeeze-Bulb Switch Cord Set: Plug and 72-inch (1800-mm) washable tube with white, washable, neoprene squeeze-bulb activator, plug-mounted, momentary contact switch.

Ethylene oxide, sterilize-able.

Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.

Quantity: 2 cord sets for every 10 patient beds.

Call-Button Plug: Designed to plug into patient station cord-set receptacle. Button switches call circuit. Furnish 2 plugs for every 10 patient beds.

Dummy Plugs: Designed to plug into patient station cord-set receptacle when call-button plug or patient cord set is not used. Furnish 3 plugs for every 10 patient beds.

Indicator Lamps: Light-emitting-diode type with 20-year rated life, unless otherwise indicated.

Retain one of two paragraphs below to select material and finish for faceplate.

Station Faceplates: Type 302 stainless steel, 0.0375-inch (0.95-mm) minimum, on brushed finish. Machine-engraved labeling identifies indicator lamps and controls.

Station Faceplates: High-impact plastic, [beige] <Insert color> color. Molded or machine-engraved labeling identifies indicator lamps and controls.

In first paragraph below, coordinate number of lamps with functional requirements.

Corridor Dome Lights and Zone Lights: Three-lamp signal lights.

Lamps: Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.

Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.

Revise colors in subparagraph below to suit Owner's preference.

Filters: Two per unit, amber and red.

Cable: Features include the following, unless otherwise indicated:

Conductors: Jacketed single and multiple twisted-pair, copper cables. Sizes and types as recommended by equipment manufacturer.

Cable for Use in Plenums: Listed and labeled for plenum installation.

Earthing Components: As specified in Division 16 Section "Earthing."

## **12. EXECUTION INSTALLATION**

To select system wiring method, retain one of first two paragraphs below and revise to suit Project. Coordinate with Drawings.

Wiring Method: Install wiring in raceway except within consoles, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

Wiring Method: Install wiring in raceway except within consoles, desks, and counters; and except in accessible ceiling spaces and in gypsum board partitions, where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces including plenum ceilings.

Conceal cable and raceway wiring except in unfinished spaces.

Install cables without damaging conductors, shield, or jacket.

Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

Pull cables without exceeding cable manufacturer's recommended pulling tensions.

Pull cables simultaneously if more than one is being installed in same raceway.

Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.

Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.

Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train conductors to terminal points with no excess. Provide and use lacing bars in cabinets.

Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide 12-inch (300-mm) minimum separation between conductors to speaker microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.

Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures. Install



terminal cabinets where there are splices, taps, or terminations for eight or more conductors.  
Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.

Identification of Conductors and Cables: Retain color-coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams. Label stations, controls, and indications using approved consistent nomenclature.

Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

Label exposed cables at intervals not exceeding 15 feet (4.5 m).

Prepare cable administration drawings to show building floor plans with cable administration point labeling. Identify labeling convention and show labels for terminal hardware and positions, cables, stations and devices and equipment earthing conductors.

### **13. EXISTING SYSTEMS**

Retain this Article if equipment being specified is to connect with existing sound, intercommunication, or nurse call equipment.

Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.

### **14. EARTHING**

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment earthing except at connection to main building ground bus.

### **15. FIELD QUALITY CONTROL**

Retain first paragraph below to require a factory-authorized service representative to perform, or assist Contractor with, field inspections, tests, and adjustments. Retain one of two options to suit Project; delete both to require only an inspection before field testing.

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect[, test, and adjust] field-assembled components and equipment installation, including connections[, and to assist in field testing]. Report results in writing.

Test Procedure: Comply with the following:

Schedule tests a minimum of seven days in advance of performance of tests.

Report: Submit a written record of test results.

Operational Test: Perform an operational system test, and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and all-call messages and pages at each nurse call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system. Meet the following criteria:

Speaker Output: 90 dB plus or minus 3 dB, 300 to 3000 Hz, reference level threshold of audibility 0 dB at 0.02 milli Pascal of sound pressure.

Gain from patient's bedside station to nurse station, with distortion less than 65 dB (plus or minus 3 dB, 300 to 3000 Hz).

Signal-to-Noise Ratio: Hum and noise level at least 45 dB below full output.

Test Procedure:

Frequency Response: Determine frequency response of two transmission paths by transmitting and recording audio tones.

Signal-to-Noise Ratio: Measure the ratio of signal to noise of the complete system at normal gain settings, using the following procedure: Disconnect a speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse call equipment amplifier, and measure the distortion in the amplifier output.

Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets these Specifications and complies with applicable standards. Report results in writing.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

## **16. ADJUSTING**

Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sound levels and controls to suit actual occupied conditions. Provide up to [three] <Insert number> visits to Project during other-than-normal operating hours for this purpose.

## **17. DEMONSTRATION**

Engage a factory-authorized service representative to train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse call equipment.

## **SECTION - S**

### **SECURITY ACCESS SYSTEM - VELOCITY SYSTEM**

#### **1. GENERAL**

##### **1.1 Section includes**

Security access system, Velocity by Hirsh Electronics, including the following:

1. Server hardware and software.
2. Application software.
3. Intrusion detection devices.
4. Security access devices.
5. Access control, relay control, and alarm monitoring controllers.

##### **1.2 RELATED SECTIONS**

A. Section 16050 - Basic Electrical Materials and Methods.

##### **1.3 REFERENCES**

A. NFPA 70 – National Electrical Code.

B. UL294 – Standard for Access Control Systems.

C. NFPA 72 – National Fire Alarm Code.

D. NFPA 101 - Life Safety Code.

##### **1.4 REGULATORY REQUIREMENTS**

A. System shall be UL-Listed.

##### **1.5 EXISTING SYSTEM DESCRIPTION**

A.

## 1.6 NEW SYSTEM DESCRIPTION

- A. The Hirsch Electronics "VELOCITY Version 3.1 Security Management System shall be a modular and network capable access control and intrusion detection system. The Security Management System shall have the ability of handling corporations with multiple remote sites, controlled access with various reader technologies supported simultaneously, alarm monitoring with text and graphics based annunciation, Photo Call-Up, Photo ID Budging, DVR and CCTV switcher control that allows for easy expansion or modification of readers, inputs, and outputs. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished on-line through system programming, without hardware changes.
- B. The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, such as camera switching, activation of remote devices, email of alarm/event, text page of alarm/event, Threat Level change, and door control.
- C. Access control functions shall include, validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card/PIN, and PIN.
- D. The VELOCITY System shall interface to the CCTV matrix control system through a serial software interface, simulating alarm inputs. The CCTV system shall be programmed to respond to the alarm input, switching the appropriate camera(s) to the appropriate monitor/s and/or recording devices. All control of camera selection, position, zoom, focus, iris, pre-position, etc. shall be controlled by the CCTV system's keyboard/joystick controls or the Velocity computer keyboard and mouse. Advanced switcher programming shall be performed through the switcher and associated keyboard or software programming interface.
- E. The VELOCITY System shall interface to the DVR system through an API software interface. The DVR system shall be programmed to respond to the alarm inputs through Velocity's Triggers/Actions Manager. In response to an alarm, the DVR shall record video as programmed, including: Pre-Alarm, Alarm Duration, Post Alarm, and Frames per second as defined for that camera. All control of position, zoom, focus, and iris shall be controlled by the DVR system's keyboard/joystick controls or the Velocity on-screen PTZ controls. Initial DVR setup and Advanced programming shall be performed through the DVR's configuration software programming interface.

- F. Utilizing assigned passwords, it shall be possible to define the levels of system operation for each individual Operator. Operator Actions range from basic monitoring to full control of the system databases.
- G. The system programming shall be user-friendly Windows environment (use conventional "Title Bar", "Menu Bar", "Tool Bar" and "Status Bar") and allow mouse control of key functions. The programming shall be MENU driven and include on-line "Documentation", "Help" or "Tutorial" information. The software shall utilize combo boxes for previously entered system-required data where applicable.
- H. The system shall provide supervised alarm point monitoring. Upon recognition of an alarm, the system shall be capable of displaying alarm information in text format in a dedicated Alarm Viewer, real-time status in a Status Viewer, on a graphic floor plan, initiate alarm recording on a DVR, switching CCTV cameras, email an alarm notification to one or more people, and send a text page to a cell phone or display pager that are associated with the alarm point. The system shall be capable of arming or disarming alarm points both manually and automatically, by time of day, and day of week.
- I. The method of communication from remote locations to the central components shall be transparent to the user.
- J. After installation, the OWNER shall be able to perform hardware configuration changes as desired without the services of the MANUFACTURER.
- K. Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.
- L. All controller components shall utilize "Distributed-Processing" concepts. The distributed processing shall include the ability to down-load operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of any other system component.
- M. The system shall be capable of utilizing the existing LAN / WAN connecting the buildings or a dedicated security Ethernet network for Hirsch DIGI\*TRAC Controller and Velocity Client communications. Install Hirsch SNIB2 communications interface in each controller to communicate to the controllers via 10/100 Mbps, 128 bit AES encrypted Ethernet.
- N. The Controllers shall utilize Version 7.4 or later Flash downloadable CCM (Command and Control Modules) firmware.
- O. Upgrade CCM Firmware in existing controllers as required.

### 1.7 ALTERNATES:

- A. Alternate Item #1: Provide a complete photo ID Budging system, including: Pan/Tilt/Zoom camera with Synchronized Flash, Tripod, and backdrop (Hirsch Model IDCAMKIT; Ultra Magic Card RIO Printer (Hirsch IDP-MLR); Printer Rolls (Hirsch Model IDP-ML5-PR).
- B. Alternate Item #2: Provide a Dual Monitor PC Card (Hirsch Model DMC) and an additional 17 inches (423 mm) Flat Panel Monitor (Hirsch Model HMS-M17FP).
- C. Alternate Item #3: Provide as an option a Fault-Tolerant Server Computer, Windows Server 2003 R2 operating system, SQL Server 2005 database, 17" Flat Panel Monitor (Hirsch Model HMS-L2D-3-17FP).

### 1.8 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Manufacturer's Data:
  - 1. Submit three (3) copies of:
    - a. Product Data Sheets.
    - b. Installation Instructions.
  - 2. Authorized Dealer Certificate and Certified Training Certificates of installers who will be working on this project.
- C. Shop Drawings:
  - 1. Submit three (3) copies and digitally in AutoCAD 14 or later format on a CD (3 copies), shop drawings, including:
    - a. Layout of equipment on supplied AutoCAD drawings.
    - b. Security Console elevation drawings.
    - c. Field Controller equipment location wall layouts, including size requirements.
    - d. Detailed wiring diagrams of Field Controllers, Door Details, and head-end devices.
    - e. Load calculations of all security equipment for proper sizing of electrical provided by the customer and standby emergency generator circuits.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

**F. As-Built Drawings:**

1. Update Shop Drawings to create final As-Built Drawings. Submit 3 copies and digitally in AutoCAD 14 or later format on a CD (3 copies).

**G. Operation Data:** Include three (3) copies of the software Administrator and Operator Manuals.

**H. Maintenance Data:** Include maintenance and repair procedures.

**1.9 QUALITY ASSURANCE**

**A. Manufacturer:** The access control system shall be from a single-source manufacturer that specializes in intrusion detection and access control systems with a minimum of 5 years experience.

**B. Installer:** Company specializing in intrusion detection and access control systems with a minimum of three years experience on systems of similar size and scope. Technicians working on project must have been certified on the hardware and software used for this project.

**C. Mock-Up:** Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
- 4.

**1.10 DELIVERY, STORAGE, AND HANDLING**

**A.** Owner will provide, on-site, a secure, dry, locked storage area for all equipment delivered under this scope of work.

**B.** Store products in manufacturer's unopened packaging until ready for installation.

**C.** Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

**1.11 PROJECT CONDITIONS**

**A.** Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### 1.12 WARRANTY AND SERVICE AGREEMENT

- A. All equipment, materials, and labor shall be guaranteed for a period of 24 months from the date of final acceptance by the Owner.
- B. Provide any software maintenance updates or upgrades at no additional cost to the Owner for this period.
- C. Perform two (2) scheduled preventative maintenance site visits per year during the warranty period.
- D. Response Times – Normal business hours shall be 7 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.
- E. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.
- F. Submit an all-inclusive Annual Maintenance Agreement cost for years 3 and 4, including two (2) preventative maintenance sites visits per year.
- G. Submit normal and after hours labor costs and typical costs for equipment for items not covered under the Warranty, like: Acts of God, vandalism, misuse.

#### 1.13 EXTRA MATERIALS

- A. Provide one (1) each of the following Hirsch Electronics components to serve as system spares:
  - 1. SNIB2 – Secure Network Interface Board (as required).
  - 2. MRIB – MATCH Reader Interface Board (as required).
  - 3. DS47L (as required)
  - 4. DS47L-SPX (as required)
  - 5. Card Reader (as required)

### PRODUCTS

#### 1.14 MANUFACTURERS

- A. Acceptable Manufacturer: Hirsch Electronics; 1900-B Carnegie Ave., Santa Ana, CA 92705. ASD. Toll Free Tel: (888) 809-8880. Tel: (949) 250-8888. Fax: (949) 250-7372. Email: [info@hirschelectronics.com](mailto:info@hirschelectronics.com). Web: <http://www.hirschelectronics.com>.
- B. Substitutions: Not permitted.



- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

#### 1.15 BASIC CENTRAL SYSTEM COMPONENTS

- A. Security Management System: Hirsch Electronics Corporation, Velocity Security Management System, model VEL (Velocity Server plus unlimited remote clients).

B. Central Processing Unit Computer Specifications:

1. The software shall operate on a Dell or equal personal computer. The requirements for the computer, rated to the size of the system, are as follows:

C. Central Processing Unit (CPU):

1. The computer CPU shall be type Pentium 4, 2GHz/533MHz or greater.

D. Random Access Memory (RAM):

1. The computer shall have a minimum of 1GB RAM for the Server (plus 40MB per active client) and 512 MB RAM for Clients and Single User Workstation running on Windows XP Professional SP2 or Windows Vista (1GB recommended).

E. Disk Drives:

1. The computer shall have a 40 GB IDE, SATA or SCSI hard disk drive minimum, a 3.5" floppy disk drive, and CD-ROM (CD-R on the Server recommended).

F. Monitor:

1. The computer shall have a 17" Flat Panel Monitor, XGA color.

G. Mouse:

1. 2 button bus type

H. Keyboard:

1. The computer shall have a standard 101-keyboard layout and IBM-compatible.

I. Modem:

1. The modem shall be a 56K internal modem with PC Anywhere 12 Remote Control Software for the server computer. The owner will provide a dedicated voice-grade phone line at the Head-End Server location.

J. Serial Ports:

1. Provide 2 serial ports.

K. Parallel Ports:

1. Provide 1 parallel port.

L. Ethernet Port:

1. Provide 1 10/100/1000 Cat5 Ethernet port (onboard or separate card)

M. Sound Card and Speakers:

1. Provide audio output (onboard or separate sound card) and speakers.

N. Operating System:

1. The VELOCITY Server computer shall operate under Windows Server 2003 SP1 or R2 and the Single User Server or Client shall operate under Windows XP Professional SP2 or Windows Vista. 32 and 64 bit versions shall be supported.

O. Database:

1. The VELOCITY Server shall have Microsoft SQL Server 2005 Express Database included and loaded with the application. The system shall optionally run on MS SQL Server 2005. 32 and 64 Bit versions shall be supported.

P. Printers: (as required for each workstation)

1. Report Printer - The computer shall have one parallel or USB printer port, and corresponding printer, Hirsch Model HMS-PLBW Laser Printer, and printer drivers for Windows XP Pro SP2.
2. Budgeting Printer - The computer shall have one parallel or USB printer port, and corresponding printer Hirsch ID Badge Printer, Hirsch Model IDP-MLR, and printer drivers for Windows XP Pro SP2.
3. Alarm and Event Printer - The computer shall have one parallel or USB printer port, and corresponding printer, Hirsch Model PR-1 Dot Matrix Printer, and printer drivers for Windows XP Pro SP2.

Q. UPS:

1. The UPS (Uninterruptible Power Supply) for the Server, Hirsch Model UPS-HMS, and Client, Hirsch Model UPS-HMS, shall provide for 20 minutes of continued operation in the event of an AC Power Failure.

R. Tape Drive – Internal on Server:

1. The tape drive shall be a 20/40 GB Travan, Model Hirsch HMS-TBI. Provide 12 Blank Tapes.

S. Tape Drive Software

1. The tape drive software shall be Symantec Backup Executive.

T. Communications Interface To Field Controllers Supported:

1. RS-232.
2. RS-485.
3. TCP/IP.
4. Dial Up.

U. Control Panel Specifications:

1. The control panel shall incorporate microprocessor-based, digital technology, using high speed processing for maximum reliability.

V. Distributed Intelligence:

1. The system shall use distributed intelligence architecture, with controllers operating independently of one another.
2. Regionalized functions for all controllers connected to an Xbox communications loop shall include: Use Count, Absentee Limit, Temporary Days, Pass back, and Input/output linking and shall not require the host to be online for processing and control.

W. Stand Alone Operation:

1. All database information required for stand-alone operation shall be stored at the control panel level. All decision-making shall be performed at the control panel, eliminating the need for degraded mode operation.
2. Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in Flash Downloadable Read Only Memory.

X. XML Writer Application:

1. The system shall support as standard sending any or all event and alarm transaction events out of a selected port in a standard XML format.
2. A Time Zone may be defined to limit when this data is exported.
3. Multiple XML Writers may be defined and run concurrently for different applications.

Y. MS Message Queue Application:

1. The system shall support as standard sending any or all event and alarm transaction events in a standard XML format to a Microsoft Message Queue.
2. A Time Zone may be defined to limit when this data is sent to the queue.
3. Multiple MS Message Queues may be defined and run concurrently for different applications.

## 1.16 SYSTEM CONFIGURATION

- A. The head-end shall support one (1) Server Computer that may optionally be used as a full functioning Client. The system shall support unlimited remote Client computers with full system functionality. The unlimited client capability will be inherent to the software and will not require additional licensing by the manufacturer.
- B. The server software shall support Cold Redundant, Warm Redundant, Hot Redundant, and Clustered server environments.
- C. During installation, support for a split SQL Server Database server and Application/Communications server shall be available.
- D. Host Computer to Controller Communication Protocols:
  - 1. Communications between the computer and the controller shall be accomplished by Scramble\*Net Communications and shall be encrypted using a 64-bit cipher feedback method (HES - Hirsch Encryption Standard). The encryption shall be full time and not require any programming or key setting to operate.
  - 2. The system shall utilize RS232 up to 50' for hardwired applications.
  - 3. The system shall utilize RS485 up to 4000' (4-wire hardwired). Longer distances are allowed with a communications multiplexer / amplifier (Hirsch Model NET\*MUX4), if applicable.
  - 4. The system shall utilize TCP/IP for communicating over dedicated or shared Ethernet networks. For 10/100 Ethernet communications to the controller, install SNIB2 128 Bit AES Encrypted communications interface board in each controller.
  - 5. All of the communications protocols shall be supported simultaneously on the system.
- E.
- F. Host Computer to Controller Communication Transmission Methods/Hardware:
  - 1. Communications between the computer and the controller shall be able to use any or all of the following methods:
    - a. Hardwired.
    - b. Leased line modem.
    - c. Fiber Optic.
    - d. Microwave.
    - e. RF.
    - f. Ethernet 10/100.
    - g. Dial-Up modem.
- G. Proprietary Network Interface Hardware:

1. The controller shall be interfaced to an industry standard personal computer running proprietary software with the addition of an opto-isolated network communications interface board (Hirsch Model: SNIB). The Scramble Net Interface Board will accept RS232 or RS485 communications interface. Each board is uniquely addressable through on-board dipswitch settings and has an adjustable baud rate from 1200 – 19,200. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable.
2. Optionally, the enhanced SNIB2 communications interface board may be installed for 10/100 Ethernet, 128 Bit AES encrypted communications input to the controller. Downstream RS485 hardwired communications to controllers daisy chained off the “master” controller on any communications port can communicate up to 115 K Baud.

The SNIB2 board firmware will be Flash Downloadable to accommodate any future communication enhancements.

#### H. Maximum System Wide Capacities:

1. The following shall be the maximum system wide capacities. These capacities will be inherent to the software and do not require additional licensing by the manufacturer. The actual number shall be dependent upon the mix of controllers that make up the system:
  - a. Doors: Unlimited.
  - b. Supervised Alarm Inputs: Unlimited.
  - c. Control Relays: Unlimited.
  - d. Controllers: Unlimited.
  - e. Users: Unlimited.

### 1.17 SYSTEM SOFTWARE

#### A. General layout of the software “Windows” will include but not be limited to:

1. Main Menu Bar shall be used to access all Velocity Functions from a standard pull down menu method.
2. Tool Bar ICONS shall be used to access all common Velocity Functions with a single mouse click.
3. Customizable Graphical User Interface shall allow for configuring the screens in a variety of layouts. Layouts for each window include: Docked to the Top, Bottom, Left, and Right; Floating; Child – Minimized, Maximized, Restored. Each Operator shall have their own unique layout for available options. If dual-monitors are used, the Customizable GUI shall apply to both monitors. It shall be possible to restore factory defaults for each user with a single action.

4. Tool Tips describing the feature(s) that the selected item represent, will be displayed in small “bubbles” underneath the selected item, field caption or other component. These tool tips shall be user definable.
5. The Administration Console shall use the familiar Microsoft Explorer metaphor with a tree of folders in the left pane and details of selected folders in the right pane. The left pane shall include the following main components: Main Administration Console, Velocity Configuration, DIGI\*TRAC Configuration, and Interface Configuration.
  - a. The Main Administration Console shall include:
    - 1) Alarm Viewer.
    - 2) Badge and Graphics Designer.
    - 3) Customization Manager.
    - 4) Enrollment Manager.
    - 5) Event Viewer.
    - 6) Graphics.
    - 7) Report Manager.
    - 8) Status Viewer.
    - 9) SQL Manager.
    - 10) Velocity Scheduling Agent
    - 11) Video Explorer.
    - 12) Who’s Inside
    - 13) CCTV Camera Viewer.
  - b. The Velocity Configuration Module shall include:
    - 1) Person Templates
    - 2) Credential Templates.
    - 3) Time Zones.
    - 4) Holidays.
    - 5) Door Groups.
    - 6) Function Groups.
    - 7) Operators.
    - 8) Roles
    - 9) Command Sets.
    - 10) Workstations.
    - 11) Alarm Responses
  - c. The DIGI\*TRAC Configuration Module shall contain:
    - 1) Add either an S\*NET, X\*NET, or Dial-Up communications port, either serial or TCP/IP.
    - 2) Add XBOX
    - 3) Add DIGI\*TRAC Controller.
    - 4) Import New Controller
    - 5) Add Dial-Up Location and Modem Pool Settings.
    - 6) Doors, Readers, Inputs, Outputs, Expansion Inputs, Expansion Outputs.
  - d. The Interface Configuration Module shall define the parameters for communicating to a CCTV

switcher, Serial Port Redirector, Email Notification of Alarms, Message Queue writers, Central Station Interfaces (optional and sold separately) and DVR integration.

6. Dialog Boxes will provide a means for entering information into fields and displaying information from the System Software database.

**B. Workstation Customization:**

1. Each Operator may customize the Graphical User Interface display location and size of the software components. After Logging Off and then Logging In again, the User Interface will display the software components exactly as the Operator left them when they Logged Off.
2. Alarm Viewer will bring the “Alarm Viewer Window” forward on new alarm(s) while you are in other Velocity windows.

**C.**

**D. Time Zones:**

1. Time Zones define periods during which readers, cards, codes, alarm inputs, doors or other system features are active or inactive. Basic configuration parameters shall “ask” the Operator to define “when” the user is enabling (or disabling) a specific feature. In addition to Monday-Sunday, there shall be one day of the week called Holiday. When selected, there will be 4 Holiday Schedules that determine if the Holiday is to be followed for this Time Zone. There shall be 64 Standard Time Zones, 64 Master Time Zones, and 20 Grand Master Time Zones.

**E. Holidays:**

1. Holidays are used within the system for the purpose of defining if a Time Zone is to be followed on a defined Holiday. Each Time Zone has up to 4 Holiday schedules. There are 366 user definable Holidays this year and 366 days next year. It shall be possible for the Operator to “Make the rest of Today a Holiday”. Holidays shall be selected from a calendar, including the ability to select multiple days.

**F. Door Groups:**

1. Door Groups shall allow the user to establish groups of readers, each with its own unique Time Zone, at a facility for the purpose of granting or denying access to Credentials. Door Groups are assigned to Credential Templates, and people being added to the system take on the Door Group of the Credential Template selected during the enrollment process. A new Door Group may be defined when adding a

- Credential or Credential Template without having to exit and re-enter the Credential function for that Person.
2. The Door Group application shall allow the user to view any existing Door Group listed in the dialog box. A user, with proper authority, shall be able to modify, add, or delete a Door Group from the System Software.
  3. More than one Door Group may be added to a Credential as long as there is no overlap of a controller in a door group already added to the Credential.
  4. Door Groups may be combined into Master Door Groups, which can then be added to a Credential.

#### G. Function Groups:

1. Credentials can be assigned to perform a single User Function, like Momentary Access, or multiple functions like Momentary Access in one controller and Control Trigger Function in a relay controller for Elevator Access. When multiple User Functions are required by a Person, a Function Group may be defined and associated with one or more credentials. The Function Group requires a Scramble Pad keypad to be used, where the Person's base Credential PIN number is entered, followed by an \* (Asterisk), followed by a one or two digit Extension digit, which defines which User Function will be issued for which Control Zone. This allows for a single person to perform multiple User Functions like: Unlock Door, Relock Door, Change Threat Level, Mask Alarm Inputs, Lock Down Doors.

#### H. Credential Templates:

1. A Credential Template can be used when adding Credentials to people. The Credential will take on the properties of the Credential Template selected. This will minimize the number of keystrokes and time required to add a Credential to a person. The Credential Template properties include: Credential Name; Badge Template; Activation and Expiration Date and Time; ID Format; Card Type; Code Length; Duress Digit; Credential Function and Category; Door Group, Multiple Door Groups, or Function Group; Threat Authority; 2 Person Rule options; Use Count, Day Limit, and Absentee Limits; Apply Credential Management Globally; Tag, Alert, Disable Credential; Issue Number; Status; Executive Override for Pass back; Special Needs Access Extension.

Credential Templates may be linked, whereby any User Credentials that are added with a Linked Credential Template can be group edited by editing the definition of the Linked Credential Template. A User's credential may be unlinked and customized or it can be linked to another Credential Template.



I. Command Sets:

1. A Command Set defines an action or actions to be sent to a controller or controllers. Command Sets can include: Unlock and Relock a Door; Lock Down and Release a Lock Down on one or more doors; make the rest of today a Holiday; Mask all Interior Alarm Points; change the facility Threat Level; Forgive All Pass back. Once defined, a Command Set can be executed from the Command Set Window, or from a Graphic Floor plan ICON, if defined. There shall be an unlimited number of Command Sets available to be defined. Command sets shall be defined with pick lists and shall be restrict able by Operator Group and Workstation.

J. Roles

1. Each Operator is assigned one or more Roles that defines at each authorized workstation, what that Operator is allowed to see and do, including:
  - a. Add-Ins
  - b. Application Permissions
  - c. Cameras
  - d. Command Sets
  - e. Credential Templates
  - f. DIGI\*TRAC Hardware
  - g. Door Groups
  - h. Event Viewer Filters
  - i. Function Groups
  - j. Graphics
  - k. Person Groups
  - l. Person Templates
  - m. Reports
  - n. Status Viewer Groups
  - o. Video Explorer Groups
2. Alarm and Event Routing can be defined by Operator Role. Specific alarms and events can be routed by Time Zone to Operators to allow for only those Operators needing to see certain alarms and events can see them.

K. Operator:

1. Operators entered into the system shall take on the properties of the Role/s to which they are assigned. If the Operator is already defined in the Operating System, the "Find" feature can be used to select this Operator for use in Velocity.

L. Velocity Scheduling Agent

1. There shall be a Velocity Scheduling Agent that allows functions to be performed on an as needed basis, like activating and deactivating credentials. It can also schedule Tasks like: Synchronize Controller Clocks; Run Historical

Log Archiver; Print Reports; Email Reports; Import/Export User Data; Execute third party applications; Dial-Up remote sites; Perform Database Maintenance (backups), and Run Command Sets on a Daily, Weekly, Monthly basis.

**M. SQL Database Manager:**

1. The SQL Database Manager shall launch SQL Server Management Studio Express for manual backups and restoration of backups when running SQL Server 2005 Express.

**N. Diagnostic Window:**

1. There shall be a Diagnostic Window available to aid in system diagnostics / troubleshooting. Once a Controller is selected, the Standard Setup and Status diagnostic commands may be selected from a drop down list and sent to the selected controller. The response from the controller is displayed in the Diagnostic Window, and may be viewed, copied to the clipboard, a Report created and printed or saved to a file.
2. In addition, any supported DIGI\*TRAC Command can be sent to the selected controller.

**O. Status Viewer:**

1. There shall be a Status Viewer which displays in a spreadsheets type format, the real-time status of all or selected Doors, Readers, Inputs, Relays, Expansion Inputs, Expansion Relays, and Controllers. Devices may be grouped in to "Status Groups", which are selectable from a drop down list. Devices may have selected information displayed. The available list includes the following:
  - a. Name and Address.
  - b. Status.
  - c. Alarm and Acknowledged Status.
  - d. Masking Status.
  - e. Line Module Input Status and Type.
  - f. Relay Status.
  - g. Detailed relay status
  - h. Controller Threat Level status
  - i. Revision Number.
  - j. Enabled Status.
  - k. Controller Alarm Relay, Tamper, and Battery Status.

**P. Alarm Viewer:**

1. The Alarm Viewer shall have 4 panes: Alarm, Acknowledged Alarms, Instructions, and Comments. At the bottom of the Main Console display are counters to indicate Active Alarms, Acknowledged Alarms, and Off Normal Conditions. Double clicking the Counter will launch the Alarm Viewer. The Alarm Viewer may also be manually launched, or

automatically in the event of a new alarm occurrence. Alarm Viewer properties that may be configured include:

- a. Require Acknowledgement Before Clearing.
  - b. Auto Acknowledge on RTN (Return to Normal).
  - c. Require Entry of Note on Acknowledgement.
  - d. Force New Note on Multiple Acknowledgements.
  - e. Require Entry of Note on Clear.
  - f. Force New Note on Multiple Clear.
  - g. Restore Alarm Viewer on New Alarm.
  - h. Specify the number of Cached Alarms to Load at Launch of Alarm Viewer.
2. Foreground, Background, Alarm, and Secure colors may be changed. In addition, the Columns of data viewed in the Alarm and Acknowledged windows may be selected and the sequence in which they will appear. The available columns include:
- a. ICON.
  - b. DVR Video.
  - c. Count.
  - d. Controller Time.
  - e. Host Time.
  - f. Description.
  - g. Address.
  - h. Level.
  - i. Alarm ID.
  - j. Acknowledge Time and Acknowledged By (available for the Acknowledged Pane).
3. Tool bar ICONS shall include:
- a. Acknowledge Selected.
  - b. Clear Selected.
  - c. Acknowledge All.
  - d. Clear All.
  - e. Add Note.
4. Right Clicking an Alarm Event shall display a list of available options, including:
- a. Acknowledge.
  - b. Clear.
  - c. Acknowledge All.
  - d. Clear All.
  - e. Record Note.
  - f. Go To Graphic.
  - g. Display User Photo.
  - h. Replay WAV file.
  - i. DVR Alarm Video: Show Viewer and Get Recorded Alarm Video.

**Q. Event Viewer:**

1. The Event Viewer can display all or Filtered Transactions. Custom filters may be defined and selected, or Standard

selections can be made for main categories of Event types. Column width, order, selection, and scrolling direction are user definable, as well as text and background color.

2. The number of cached events to load when launched, up to 10,000, may be defined. The Operator shall be able to scroll back in time to view events no longer seen on the screen, without the need for running a report.

R. Velocity Learning Center - An Internet Explorer like “Velocity Learning Center” page shall be available for accessing on-line help, tutorials, manuals, Known Issues, and Product Registration information.

S. Create Defect Report

1. There shall be a wizard to create a system defect report to aid in reporting issues to factory technical services personnel.

T. Customization Manager:

1. There shall be a Customization Manager that allows the Operator to define an alternate language or change the English name or label for each element of the software.
2. Audio WAV files may be defined for playback when a particular Alarm Type is active.
3. Priority Levels may be defined (1-99) for each Alarm Type.
4. Operator Instructions per Alarm Type shall be user definable.
5. Individual Alarm Points may be customized on an individual point level, where each alarm point can have a unique priority, way file, and operator response instructions.
6. Alarm points that are customized can have an assigned “escalation” where if an operator doesn’t respond in a user defined period of time, the alarm event can be escalated to another Operator with the selected Role.

U. Report Manager:

1. The Report Manager shall allow the Operator to select from a number of pre-defined Reports. Custom Reports can be created outside the software, and added to a Custom folder, making the Custom Reports available from within the Report Manager application.
2. Once a Report is selected, the default Criteria and Sorting options may be used, or custom Criteria and Sorting options may be selected. The report criteria can be optionally displayed on the top of the report.
3. Once the report is run, it may be viewed, printed, or saved in various standard file formats.
4. Standard Reports included as standard shall include:
  - a. Customization Reports:
    - 1) Component Resources.
    - 2) Customizations Report.

- b. DIGI\*TRAC Configuration
  - 1) Controllers.
  - 2) Doors.
  - 3) Expansion Inputs.
  - 4) Expansion Relays.
  - 5) Inputs.
  - 6) Network Layout.
  - 7) Printers.
  - 8) Readers.
  - 9) Relays.
- c. History Logs:
  - 1) Active Alarms by Date.
  - 2) Alarm Log by Date.
  - 3) Alarm Log by Date with Comments.
  - 4) All Events Log.
  - 5) External Events Log.
  - 6) Internal Events Log.
  - 7) Operator Log.
  - 8) User Activity Log.
- d. Person Information:
  - 1) Credential Status.
  - 2) Door Access by Person.
  - 3) Dossier Style by Person.
  - 4) Expired and To-Be-Expired Person Access.
  - 5) Expired Credentials.
  - 6) Last Access by Person.
  - 7) Person Access and Function Group Summary.
  - 8) Person Access and Function Group Summary with Codes and Cards.
  - 9) Person Access by Door.
  - 10) Person Access Summary.
  - 11) Person Access Summary with Codes and Cards.
  - 12) Person FG Summary with Codes and Cards.
  - 13) Person Function Group Summary.
  - 14) Who Is Inside Where.
- e. Velocity Configuration:
  - 1) Command Sets.
  - 2) Door Groups.
  - 3) Function Group Extensions.
  - 4) Functions Groups with Users.
  - 5) Functions with Users.
  - 6) Holiday Schedules.
  - 7) Holidays.
  - 8) Master Door Groups.
  - 9) Master Door Groups with Persons.
  - 10) Operator Groups.
  - 11) Operators.
  - 12) Time Zones – Grand Master Time Zone.
  - 13) Time Zones – Master Time Zone.

- 14) Time Zones – Standard Time Zone.
- 15) Time Zones – Standard Time Zones in Use.

**V. CCTV Interface:**

- 1. System Software shall allow the ability to define, view, monitor, and control the CCTV Matrix Control System. Simulated Alarms can be sent to the switcher, as well as Tours, Presets, select a specific camera, Grab and Store a CCTV image, and pan/tilt/zoom/iris controls for the selected camera. In addition, one or more Triggers and Actions can be defined for each camera.

**W.DVR Interface:**

- 1. The DVR interface configuration allows a qualified Operator to add a new DVR to Velocity. Properties defined when adding a DVR include:
  - a. DVR Name.
  - b. DVR Description.
  - c. DVR Vendor (American Dynamics: DV8000, DV16000, Intellex IP, and Ultra; and Integral Technologies DVX series currently supported).
  - d. DVR I.P.
  - e. I.P Port (Control).
  - f. I.P. Port (Live Video).
  - g. DVR Server Name.
  - h. Port (Listen).
  - i. Time Zone.
  - j. DVR Enabled.
- 2. From the DVR Interface Configuration, the Operator shall be able to Search and Retrieve video from one or more cameras for a specified period of time. In addition, the Event Viewer History enables a qualified Operator to track and report events that are specific to the DVR subsystem history logs. These logs include:
  - a. Active Alarms by Date.
  - b. Active Alarms by Date with Comments.
  - c. Alarm Log by Date.
  - d. Alarm Log by Date with Comments.
  - e. All Events Log by Category.
  - f. All Events Log by Date.
- 3. The DVR interface shall allow a qualified Operator to:
  - a. View Cameras.
  - b. Generate a Host Alarm.
  - c. Stop a Host Alarm.
  - d. Get Alarm List from DVR.
  - e. Search and Retrieve Recorded Video.
  - f. Play Local Video.
  - g. Time Synchronization.
  - h. Diagnostics.

- i. View DVR Properties.
4. When Viewing cameras, the Operator may select Small, Medium, or Large display size, and select for viewing 1, 4, 9, or 16 cameras to display in the View Window. Cameras may be selected then dragged to the window the Operator wishes to view the camera in. If the camera has Pan/Tilt/Zoom/Focus/Iris control, the Operator can open the control functions and operate the on-screen controls for the selected camera.
5. An Operator shall be able to define Triggers and Actions that allows Alarms and Events in Velocity to cause Alarm recording in the DVR through an API interface. A camera preset can be defined as well as a View Group to automatically display on alarm.
6. In Graphics, DVR Cameras and DVR recorder ICONS can be placed on floor plans and used to view the associated video from the selected camera.
7. Video can be exported from a DVR and store it on the Velocity PC, then transfer the video to other media like CD-R and CD-RW.
8. There shall be a Velocity Video Explorer application that lets a qualified Operator to view multiple cameras from multiple DVRs in a single window. Cameras can be displayed in 1, 4, 9, or 16 display views and these views can be saved as View Groups for fast and easy selection by the Operator.
9. Alarms can be sent from the DVR to Velocity. Alarms include: Motion and Video Loss. When used with MATE Behavior Watch advanced analytics, these alarms can be displayed in Velocity

#### X. Console Preferences:

1. The Console Preferences shall define specific settings or devices for use with Velocity. These shall include: Show Splash Screen on Startup; Access and Enable Customized Values for Components in Customization Manager; Use 24-Hour Time Format; Automatically start Velocity when computer starts; PIN and Code reuse options; Display Credential template and time to display; SQL Server and Network Connections settings; Alarm Options for Stacking, Make Note requirements, repeat Multimedia until Acknowledged, and Alarm Queuing options; Report, Budging, and Alarm/Event Printer properties; CCTV Properties.

#### Y. DIGI\*TRAC Configuration:

1. This function shall contain the required definition of the hardware components of the system. The database files shall be based on the hierarchy of the system hardware as it is physically installed in the field.

- a. The system shall have the ability to export controller configurations in an XML format for later use on this or other systems.
- b. The system shall have the ability to import a previously exported controller configuration for ease of adding a new system.
- c. The system shall have the ability to drag and drop and duplicate controllers in the hardware tree. No reprogramming of Door Groups shall be required when dragging and dropping one or more controllers in the hardware tree.

**Z. Controller Properties:**

1. Controller Properties shall define all General settings for the Controller. These settings will include: Name, Type, Address, Local Time Zone, Enabled Status, Firmware Revision Number and Date, Expansion Option Boards Installed and available Hardware. All additional Controller Setup Options can be defined here and are detailed in the Firmware Features section below.

**AA. Controller Device Properties:**

1. The Controller Device Properties shall define all connected field devices, including: Doors, Readers, Inputs, Relays, Expansion Inputs, and Expansion Relays. Device names and all operating parameters shall be definable if operation other than the included defaults is required.

**BB. Graphics:**

1. The Graphics application shall allow the Operator to add, delete or modify graphic floor plans and add indicator ICONs to graphic floor plans that represent Controllers, input/output points, readers, or cameras located in the facility. Formats for Graphics supported include: jpg; bmp; dxf; wmf; emf.
2. There shall be two Modes, Live and Design. The Live mode shall be used for real time monitoring. In addition, right clicking an ICON presents the Operator with a list of available Access or Control Functions that can be issued to the device. The Design mode allows the Operator to Define which Graphics are to be used, place ICONs on the Graphics, and define properties for each ICON.
3. There shall be a Pan and Zoom Viewer that provides a key plan that can be panned and scrolled by moving the red box, which indicates the current viewing area.
4. There shall be a Directory of available Graphics to easily select the desired Graphic to display.
5. The Graphics application shall display the real-time state and condition of Alarm Points and Doors. The Door ICONs shall change from a closed door ICON to an Open door ICON,



representing that the door is open. When the door is closed, a closed ICON will appear again. The Alarm ICONs shall change from a closed contact ICON to an Open contact ICON, representing that the alarm device is active. When the Alarm Device is restored to its normal condition, a closed contact ICON will appear again. The ICON will also display the Device Name and Alarm Condition that caused it to go into an Alarm condition. The Color of the ICON will also change based on whether it is in alarm or secure.

6. User definable ICONs can be created and used. Link ICONs can added to quickly link to other graphics. Command Set ICONs can be used to issue a Command Set with a single mouse click.
7. Custom Links shall be available to provide additional functionality. These links include:
  - a. AXIS Camera Link – This link shall enable the Operator to launch an AXIS IP camera from any graphics page. A dedicated viewer window will open for each camera link by double clicking the link.
  - b. Quick Link – This link shall enable an Operator to launch an HTML page from any graphics page. A dedicated window will display the defined HTML page when the link is double clicked.

CC. Badge and Graphics Designer:

1. The Badge and Graphics Designer shall allow the Operator to create and customize an unlimited number of Badge Templates that may be assigned to a Person in the Enrollment Manager and create Backdrops to be used in the Graphics module.
2. An Object Toolbar shall be available for selecting Objects to appear on the Badge Template or Backdrop, including: Bit Map Logos, Photos, Fixed Text, and Database Fields. Each Object shall have a Properties box where the specific Properties of that Object are defined, including: File, database field, Font Color, Font Style, Font Size.

DD. Enrollment Manager:

1. The Enrollment Manager application shall maintain information related to a Person, and Credentials assigned to that person. Multiple Credentials per person shall be supported. New people can be added with the assistance of a Person Template to automatically enter User Defined field data and select Person Groups for this person.
2. The Personal Information pane shall include the General, 10 Additional Tabs, and a Person Group tab. The system shall be capable of defining 999 user definable fields and place them

on any of the 10 Tabs. The captions of the Tabs are customizable and can be restricted by Operator. There shall be an "Additional Images" tab that can be used to store additional photos of the person, photos of relatives, and/or photos of Assets assigned to the person. These field names can be either a "Text Box", "Dropdown" where the Operator can enter text, or select from a Dropdown List, a "Dropdown List" where selecting from the List is required, Date, Number, Unique number, Auto-unique, Auto-sequential, unique text, and the Dropdown and Dropdown Lists can sort in Ascending or Descending order. Fields can be made "Required", where the Person's record cannot be saved unless data is entered in that field. Field captions can have their color changed. A Photo field shall be available for acquiring a live video image, acquire an image from a TWAIN device, or acquiring a photo from an existing file. A Record Last Updated field shall be available, as well as Preview and Print a Badge. A signature field shall also be available.

3. A Person can be placed in one or more Person Groups. An Operator's Role/s determines which Users an Operator can view.
4. Once a person is added, one or more Credentials may be added to that Person. Credentials may be added using a Credential Template, or directly without a Credential Template. The Credential will take on the properties of the Credential Template if used. There shall be a Card Enrollment Station used for entering card data into the system. PIN Numbers can either be randomly selected, or Operator/User selected. Multiple card formats shall be supported, including: multiple bit length Wiegand, ABA (magnetic stripe), and custom. Each credential can have assigned one or multiple Door Groups, Master Door Groups, or Function Groups for access and control authorization. If a new Door Group is required and not currently defined, the Operator can create a new one from within the credential management application. Additional credential properties that may be assigned include:
  - a. Badge Template.
  - b. Card Data.
  - c. Hot Stamp Card Number.
  - d. Activation Date/Time.
  - e. Expiration Date/Time.
  - f. PIN Length.
  - g. PIN Number.
  - h. Duress Digit.
  - i. Day/Use/Absentee Limits.
  - j. 2 Person Rule.
  - k. Threat Authority.
  - l. Tag.

- m. Alert.
- n. Disable.
- o. Pass back Executive Override.
- p. Special Needs Access.
- q. Issue Number.

Devices may be configured to allow for scanning and automatic field data entry from a Business Card scanner, Drivers License Scanner, Passport Scanner, and PIV Smart Card Reader. Fields can be mapped to allow for proper placement of the scanned data in the correct field.

There shall be the ability in the credential management program to provide Print and Issue control for budging, where the maximum number of times a badge can be issued and printed can be set, as well the current count listed. The reason for a badge reissue shall be logged for auditing purposes.

- 5. Once a Person is selected from the List, the Credential Status and information is displayed for the assigned Credentials. The information includes: IDF, ID, Function, Description, Status, Expires On, Last Access, Last Door, Tag, and Alert. An Operator may right click on a Credential, and will be presented with the following options: Tag, Alert, Disable, Forgive Pass back, Override Code Tamper, Reset Limit Count, Force Download, Unassigned, Delete, and Properties.
  - 6. The bottom of the Enrollment Manager window shall display counters for: People, Assigned Credentials, Unassigned Credentials, and Guest Credentials.
  - 7. Multiple User search options shall be available, including: "Find Person" query search builder; form based quick search, and Quick Find.
  - 8. There shall be the capability to group edit multiple User's user defined fields and Person Groups.
- EE. Download Monitor:
- 1. The system shall display the status of all data downloads to the field controllers.
- FF. Switch Operator:
- 1. There shall be the capability to change Operators without the need for the current Operator to Log Off the computer. The new Operator's Velocity permissions are then used during the session to control access to Velocity functionality.
- GG. Velocity Data Import/Export:

1. There shall be the capability to Import user related data into the database. This data can be in either a text file, Comma Separated Value format, or XML format. The imported data can be mapped to any of the user definable fields available within the Velocity Enrollment Manager. In addition, a User's photo, signature, and credential info, including PIN, card number, hot stamp card number, and the Credential and Person Templates to use when importing are available for importing.
  2. There shall be the capability to Export user related data from the Velocity database. This exported data can be formatted in a text file, Comma Separated Value, or XML format. This data can be selected from any of the fields available in the Velocity Enrollment Manager.
- HH. Add-Ins: The following "Add-Ins" are available to be added to Velocity by an authorized Operator.
1. Velocity Remote Desktop – The Operator shall be able to launch a terminal services session from within the Velocity shell.
  2. Launch pad – The Operator shall be able to launch standard Windows applications within Velocity.
- II. Software Developers Kit (SDK): The Security Management Application shall support an SDK to allow for external third party applications to interact with the Enrollment Manager Application. It shall also provide for external event and alarm monitoring and control back into the application in an XML format.
1. API – There shall be available as an option, an Application Programming Interface to allow third party applications to manage Users and Credentials in the Security Management application, including add, edit, and delete functions.
  2. XML – There shall be available as an option, an XML interface to allow for the Security Management application to receive commands in an XML format, as defined by the SDK, to perform commands like: List Alarms, Acknowledge Alarms, Unlock Doors, issue Command Sets, and others, and to provide command responses in an XML format.
  3. The Vendor shall have available a Professional Services Group to assist and/or provide solutions using the SDK.

## 1.18 HARDWARE REQUIREMENTS

### A. Controllers:

1. There shall be three primary types of controllers:
  - a. Access control (1 Door [Hirsch Model M1N], 2 door [Hirsch Model M2N] and 8 door - [Hirsch Model M8N]).

- b. Alarm monitoring (16 supervised inputs - [Hirsch Model M16N]), expandable to 32 inputs.
- c. Relay control (8-32 relay [Hirsch Model MSPN-8R] with the addition of REB8 relay expansion boards and (64 relay - [Hirsch Model M64N]).

B. Each controller shall have the following common features.

1. Controller Board: The controller board shall be microprocessor based, incorporating Flash ROM (firmware) downloadable from the Host Computer, RAM (User Information, System Setups, Event Transaction Buffer) and a Clock/Calendar. The ROM shall be modularly upgradeable in the field for enhancements to system features. All powered connections to the controller board shall be protected by fuses. All wiring connections to the controller board shall be to "Phoenix" type screw terminals. Each door connection shall consist of terminals for two readers, one 10 Amp rated Form C dry output relay for lock control, and one input for monitoring a status switch, a request-to-exit device, and a tamper switch. There shall be status indicator lights for active relays, as well as diagnostic indicator lights to aid in system troubleshooting. There shall be dedicated alarm output relay/s for external reporting of the following conditions: Alarm; Duress; Tamper; and Trouble.
2. Enclosure: The controller enclosure shall be a NEMA style metal cabinet designed for surface mounting. It shall have a tampered, removable hinged door with a high security key lock. It shall have conduit knockouts to allow from 1/2" to 1" EMT conduit to be used for wire entry into the cabinet.
3. Internal Power Supply: The controller shall have an internal power supply that will accept 50 Hz/ 200 - 240 VAC, or 60 Hz/100 - 120 VAC. The primary side of the power supply shall be protected with a fuse. The power supply shall provide 28 VDC power to the controller board, internal battery charger, selected card readers, and reader interface boards.
4. Standby Battery: The controller shall have an internal standby battery that is capable of running the system during AC power interruptions. It shall be recharged by a charging circuit incorporated into the controller board.
5. Expansion Options: A maximum of five (5) expansion boards can be installed in each controller, with the exception of four (4) in the Model M64N and none in the Model 1N. A SNIB (SCRAMBLE\*NET Interface Board) is included with each controller with the "N" designation in the part number and takes up one of the available expansion slots. A SNIB2 is included with each controller with the "N2" designation in the part number.
6. Alarm Inputs: The controller shall be capable of accepting up to 32 additional supervised alarm inputs, in increments of

- eight (8). The sensitivity of the line supervision shall be 2% AA Standard. The alarm expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. This option shall be limited to 16 additional supervised alarm inputs for the 16 zone alarm input controller (Model M16N) and none for the Model M1N. The alarm expansion board shall be Hirsch Model AEB8.
7. Relay Output: The two (2) access control (Model M2N and Model M8N) and one (1) alarm monitoring (Model M16N) controllers shall be capable of accepting up to 32 additional Form C, 2 Amp rated relay outputs in increments of 8. The 1 - 32 relay controller (Model MSPN-8R) shall accept up to a maximum of 24 additional Form C, 2 Amp rated relay outputs in increments of 8. The 1 - 64 relay controller (Model M64N) and the Model M1N shall not accept any additional relay outputs. These outputs shall be used for control applications other than standard door access, such as elevator floor control, local door annunciators, HVAC interface, etc. The relay expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. The relay expansion board shall be Hirsch Model REB8.
8. CODE/Buffer: The controller shall be capable of expanding the CODE database up to a maximum of 132,000 Users with the addition of a memory expansion board. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. The CODE/Buffer expansion board shall be Hirsch Model MEB\CB64 (64,000 Users) or the MEB\CB128 (128,000 Users). Both Expansion Boards shall expand the Buffer capacity as well as the Code record capacity. The Model M1N shall not accept any CODE/Buffer Expansion board.
9. Event Transaction Buffer: The controller shall be capable of expanding the event transaction buffer up to a maximum of 20,000 events and 2,000 alarms with the addition of a memory expansion board. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. The event transaction buffer expansion board shall be Hirsch Model MEB\BE. The Model M1N shall not accept a Buffer Expansion board.
10. Intelligent Reader Interface: The control panels shall utilize an intelligent reader interface (Hirsch MR1A or MR1B) to communicate with card readers of various types. The interface shall be microprocessor based and allow data formats including ABA magnetic stripe, Wiegand (26 to 55 bit), Proximity, Bar Code, Touch Memory, RF and Biometric. The interface shall utilize a digitizing algorithm, which will convert the card data to a unique number, thus, eliminating the need for facility codes. A single interface shall support

both entrance and exit readers with keypads associated with each door. The interface shall be U.L. Listed to U.L.294. The reader interface shall be included as standard in all Scramble Pads.

## 1.19 CONTROLLER FIRMWARE

### A. General Features:

1. The software for the controller shall reside in Flash ROM (firmware) and be located on a plug removable module on the controller board to facilitate easy field upgradeability of the features. All of the necessary software for a fully functional System is located in the controller. The controller firmware shall include the following general features at a minimum and be fully supported by the VELOCITY head-end.
  - a. 3 - 15 digit keypad Code's.
  - b. Duress digit for keypad Code's.
  - c. 150 Time Zones for access restriction and automatic event control.
  - d. 128 Access Zones for access management.
  - e. 256 Control Zones for alarm and relay management.
  - f. 366 programmable holidays this year, 366 days next year. Each Holiday may be assigned to 1 – 4 Holiday Schedules.
  - g. Automatic daylight savings time clock adjustment.
  - h. 27 different functions for Code's and cards, e.g. access, unlock, re-lock, alarm mask, relay control.
  - i. Add user records.
  - j. Tag users for annunciation at host computer.
  - k. 4,000 Users.
  - l. 1500 event, 1500 alarm transaction buffer.

### B. Access Control Features:

1. The controller shall include the following access control features at a minimum:
  - a. Restrict access by: time of day; day of week; door; holiday.
  - b. Momentary Access of door up to 8100 seconds.
  - c. Extended Access for User Definable Momentary Access duration (requires Scramble Pad). Scramble Pad will display time remaining on the minute, and annunciate at the defined "Warning Time".
  - d. Special Needs Time Extension to provide additional time for Momentary Access and Door Open Too Long for selected people.
  - e. Unlock/Re-lock of door by CODE, card or Time Zone.
  - f. Door status monitoring shall allow for: door forced monitoring; door-open-too-long monitoring;

- door-open-too-long while door is unlocked; auto-re-lock of door when opened or closed.
- g. Request-to-exit masks alarm and/or unlocks door.
- h. 2 person requirement by door. A user can be defined as Normal, A/B Rule A, A/B Rule B, Executive Override. Can be disabled by Time Zone.
- i. 63 Pass back Zones. Can be disabled by Time Zone. A User can designated with Pass back Executive Override.
- j. Use Count limits on users
- k. Absentee Rule limits on users.
- l. Temporary Day limits on users.
- m. Occupancy Counting / Minimum & Maximum limits per Pass back Zone.
- n. Dead man CODE / Timer.
- o. Threat Levels – 99 Levels may be defined. Based on the Level in effect for the facility, selected readers may be disabled, dual readers in Card/Code Only During Time Zone can require dual, and selected User's Credentials can be disabled.

**C. Alarm Management Features:**

1. The controller shall include the following alarm management features at a minimum:
  - a. Momentarily mask alarm by CODE and/or card.
  - b. Mask/unmask alarm by CODE and/or card or by Time Zone.
  - c. Alarm device supervised while masked.
  - d. Tamper switch on alarm device monitored while masked.
  - e. Tamper Input may be configured to operate as a "Latch Monitor" with the appropriate door lock hardware.
  - f. Entry/Exit delay per alarm input.
  - g. Alarm input triggers relays.

**D. Relay Control Features:**

1. The controller shall include the following relay control features at a minimum:
  - a. CODE and/or card, input, or other relay triggers relays.
  - b. Trigger relay/s by time zone.
  - c. Relay may be normally de-energized or energized.
  - d. Disable relay/s during time zone.
  - e. Clear relay at end of time zone.

**1.20CARD READER/KEYPAD SPECIFICATIONS**

**A. Readers:**



1. The controllers shall accept all of the following reader technologies concurrently: Scrambling Keypad; Mag Stripe; Wiegand; Proximity; Smart Card; Bar Code; Biometrics - Retinal Scan, Hand Geometry, Fingerprint; Radio Frequency. The readers can be used for access control, alarm management, and/or relay control and shall be capable of being used alone (keypad only, card only) or a scrambling keypad and any other reader technology may be combined to operate as a dual technology reader where two valid IDs (PIN and card) are required.

**B. Scramble Pad:**

1. The controller shall be capable of using scrambling keypad readers. The keypad shall incorporate the following features: Scrambling display of numbers 0 - 9 (numbers appear in different location every time it is used); +/- 4 degree horizontal and +/- 26 degree vertical viewing restriction; accept 3 - 15 digit CODEs simultaneously; be disabled for 1 minute and report CODE Tamper violation (guessing CODEs); be disabled and report Physical Tamper violation (attempt to remove keypad from mounting box); silent CODE duress; status LEDs for reporting granted, denied, and overridden transactions, AC Fail, Programming Mode active, responses to Status Request of Alarm Inputs and Relay Outputs; weather resistant; supervised by controller; and built-in diagnostics. The Scramble Pad shall include the MATCH Reader Interface functionality for connection of up to two (2) card readers. The scrambling keypad shall be the Hirsch Scramble Pad Model DS47L.
2. A version of the scrambling keypad shall be available for use in high ambient lighting conditions or where the front is subject to direct sunlight. This version shall have a +/- 26 degree horizontal and +/- 4 degree vertical viewing restriction. The high intensity display scrambling keypad shall be the Hirsch Scramble Pad Model DS47L-HI.
3. A version of the scrambling keypad shall be available with an integrated proximity card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated proximity card reader shall be the Hirsch ScrambleProx Model DS47L-SPX.
4. A version of the scrambling keypad with high intensity display shall be available with an integrated proximity card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated proximity card reader shall be the Hirsch ScrambleProx Model DS47L-SPX-HI.
5. A version of the scrambling keypad shall be available with an integrated smart card reader. Presentation of the card shall automatically auto-start the scrambling display. The

scrambling keypad with integrated smart card reader shall be the Hirsch ScrambleProx Model DS47L-SS-IE.

6. A version of the scrambling keypad with high intensity display shall be available with an integrated smart card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated smart card reader shall be the Hirsch ScrambleProx Model DS47L-SS-IE-HI.

**C. Mag Stripe Card Readers:**

1. The controller shall be capable of using standard ABA/ISO high and low energy track 2 cards and readers. The reader shall have a wide throat to accept laminated photo ID cards. For indoor and outdoor use, the mag stripe reader requires the addition of a MRIB (MATCH Reader Interface Board) or a MRIA (MATCH Reader Interface Assembly).

**D. Wiegand Card Readers:**

1. The controller shall be capable of using standard Wiegand readers and cards with 26-55 Bit standard Wiegand data formats. The readers can be swipe, insert, turnstile, or key.

**E. Proximity Card Readers:**

1. The controller shall be capable of using proximity readers that output a standard 26-55 Bit Wiegand data format. The readers can have a short or long read range and be unidirectional or bi-directional.

**F. Bar Code Reader:**

1. The controller shall be capable of using Bar Code readers and cards with standard Wiegand data format output. The reader shall be swipe, black, weather resistant, and capable of reading multiple symbols, including concealed bar codes.

**G. Miscellaneous Readers:**

1. The controller shall be capable of using any reader technology that outputs a standard ABA/ISO data format or a standard 26-55 Bit Wiegand data format. Readers that meet this requirement include: Radio Frequency; Biometrics - Hand Geometry, Retinal Scan, Finger Print, Voice Recognition; Smart Card, including Mifare, DESFire, and FIPS-201 compliant readers.

## **EXECUTION**

### **1.21 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 1.22 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Install wiring for detection and signal circuit conductors in conduit. Use 22 AWG minimum size conductors.
- C. Make conduit and wiring connections to existing door hardware devices as required.

#### 1.23 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72 – National Fire Alarm Code
- B. Test in accordance with Hirsch Electronics testing procedures for “Velocity Security Management System”.

#### 1.24 TRAINING

- A. The two designated System Administrators shall attend the 4 Day Factory Velocity Class.
- B. The Dealer shall coordinate with the System Administrators for two 8 hour Operator training sessions on the Operational System to be conducted on-site on the actual running system.

#### 1.25 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services for final system checkout and acceptance testing as required.

#### 1.26 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

## SECTION – T

### LIST OF APPROVED MANUFACTURER

#### **Low Voltage Switchboards / Distribution Boards**

- a. Hussain & Company.
- b. Zelon Engineering
- c. Electrech (Pvt) Ltd.
- d. YUWATECH Engineering
- e. Engineers & Engineering

#### **Circuit Breakers**

- a. M & G
- b. TERASAKI
- c. ABB

#### **LV Cables and Wires**

- a. Pakistan Cables Ltd
- b. Pioneer Cables
- c. NEW AGE Cables.

#### **PVC Conduits and Accessories**

- a. Galco
- b. Prince
- c. Jeddah

#### **Back Boxes**

- a. Hussain & CO.
- b. Ezzi Engineering

#### **Switch & Socket Outlets**

- a. Clipsal E-Series
- b. M.K Slim Line
- c. Orange.

#### **FAN & Accessories**

- a. Pak Fan
- b. GFC Fan
- c. Millat Fan

#### **Lighting Fixtures**

- a. Philips
- b. Zain light
- c. Osram lights
- d. Pierlite

#### **Data Communication System**

- a. Siemens
- b. Clipsal Datacom
- c. 3M

- d. Panduit

**Telephone Cable**

- a. Pakistan Cables Ltd.
- b. Pony Taiwan

**Fire Alarm System**

- a. Gent (UK)
- b. Zeton (UK)
- c. Zeta (UK)
- d. Simplex
- e. Honey Well (USA)

**Closed Circuit Television (CCTV) System**

- a. Pelco (USA)
- b. Tyco
- c. Samsung (Korea)

**Nurse Call System**

- a. C - Tec UK
- b. Rondish USA

**Lightening Protection System**

- a. W.J. Furse – U.K
- b. Erico – U.K

**Queue Management System**

- a. Guardall-(Canada)

**Public Address System**

- a. TOA
- b. Bosh
- c. Boss

**Transformers**

- a. Siemens
- b. PEL

**Cable Tray System**

- a. Unique Engineering
- b. Electrech (Pvt) Ltd.
- c. YUWATECH Engineering

**Access Control System**

- a. Zultec Group.