

TECHNICAL SPECIFICATIONS

AUXILIARY

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SECTION 16010

ELECTRONICS SYSTEMS GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

The General and Supplementary Conditions are a part of the requirements for the work under this Division of the Specifications.

1.2 WORK INCLUDED

Provide labor and materials required to install, test and place into operation the ELECTRONICS systems as called for in the Contract Documents, and in accordance with applicable codes and regulations.

Provide labor, materials, and accessories required to provide complete, operating ELECTRONICS systems. Labor, materials or accessories not specifically called for in the Contract Documents, but required to provide complete, operating Electronics systems shall be provided without additional cost to the Owner.

Under this Division of the specifications, provide all materials and equipment and perform all the work necessary for the complete execution of all the Electronics Works as shown on the Electronics Drawings, and on the General Construction Drawings, as herein specified, or both, except as otherwise excluded, and which w/o excluding the generality of the foregoing, shall include but not limited to the following principal items of work.

Fire Detection and Alarm System

Structured Cabling System

Intercom System

Complete Grounding System

Complete Testing and Commissioning of electronics system.

Fire stopping of openings in floors and walls after all conduits or pipes or ducts is in place and sealing of all such openings if not used.

Coordination with other trades especially coordinating provisions for openings, chases, inserts, etc. at site and to warn the builder of any corresponding construction error. No extra claim will be entertained due to contractor's failure

to provide the above on item.

Provision of as-built drawings, operating instructions and maintenance manuals and training of employer's staff.

Anything that has been omitted if any item of work or materials usually furnished which are necessary for the completion of the electrical work.

1.3 WORK NOT INCLUDED

The following principal items of work are not included in this Division of the specification, as they will either be carried out under other Divisions of the specifications or will be supplied and installed by others:

- A. Incoming cables from TELCO Provider up to Main Telephone Terminal Cabinet.

1.4 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations and requirements of the utility companies serving the project and the Owner's insurance underwriter.
- B. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the more stringent apply.
- C. Should any change in drawings or specifications be required to comply with the governing regulations, notify the Project Manager prior to submitting bid.
- D. All equipment and installations shall meet or exceed minimum requirements of the Standards and Codes listed under item 1.5.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced, full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

1.5 ABBREVIATIONS AND DEFINITIONS

1.6

- A. Abbreviations:

- | | | | |
|----|-----|---|-----------------------------|
| 1. | PS | - | Philippine Standard |
| 2. | PEC | - | Philippine Electronics Code |

3. ANSI - American National Standards Institute
4. ASTM - American Society for Testing and Materials
5. ETL - Electrical Testing Laboratories
6. NETA - International Electrical Testing Association
7. IEC - International Electro-Technical Committee
Institute of Electrical and Electronic
8. IEEE - Engineers
9. IES - Illuminating Engineering Society
10. NEC - National Electrical Code
National Electrical Manufacturer's
11. NEMA - Association
12. NFPA - National Fire Protection Association
13. UL - Underwriters' Laboratories Inc.
International Standard Organization
14. ISO -
15. EITC - Design Guidelines for Telecommunication
Infrastructure
Building Telecommunications Wiring
16. EIA/TIA - Standards
Building Telephone Facilities Standards
17. BTFSM - Manual
Telecommunications Distribution Methods
18. BICSI - Manual
19. FCC - Federal Communication Commission
The Fire Code of the Philippines and
20. PD NO. 1185 - Regulation
21. Other International Accepted Standards.

B. Definitions

1. Where it is stated in these specifications to submit to Engineer for review, refer to Architectural General and Special Conditions for proper procedures.
2. FURNISH means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application.
3. INSTALL means to join, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
4. PROVIDE means to FURNISH and INSTALL.

5. AS DIRECTED means as directed by the Project Manager, or his representative.
6. CONCEALED means embedded in masonry or other construction, installed behind wall furring or within drywall partitions, furniture wiring management or installed within hung ceilings.
7. SUBMIT means submit to Project Manager for review.
8. "Architect", "Project Manager/Engineer", "Owner", the Party or Parties responsible for interpreting, accepting and otherwise ruling on the performance under "this Contract".

1.6 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with the Contract Documents. Guarantee work against faulty and improper material and workmanship for a period of one year from the date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are provided or specified herein, the longer term shall apply. Correct any deficiencies which occur during the guarantee period, within 24 hours of notification, without additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

1.7 PROPOSED SEPARATION OF WORK BETWEEN THE TRADES:

- A. In the absence of more detailed information, consider the list as specific instructions to include such work in the named contract.
- B. Each Division is required to supply all necessary supervision and coordination information to any other Division supplying work to accommodate that Division.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.
- B. Products and materials shall not contain asbestos, PCB, or any other material which is installed considered hazardous by the authority having jurisdiction.

- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Project Manager.
- D. Provide name/data plates on major components of equipment with manufacturer's name. Model number, serial number, capacity data and Electronics characteristics attached in a conspicuous place.
- E. Install materials and equipment with qualified trades people.
- F. Maintain uniformity of manufacturer for equipment used in similar application and sizes.
- G. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.

PART 3 – EXECUTION

3.1 FEES AND PERMITS

- A. Pay all required fees and obtain all required permits/right of ways related to the ELECTRONICS installation.
- B. Pay royalties or fees required in connection with the use of patented devices and systems.
- C. Provide controlled inspection where required by authorities having jurisdiction or by these specifications.

3.2 SUBMITTALS AND REVIEWS

General:

- A. Submit shop drawings, manufacturer's product data sheets, samples, and test reports as specified.
- B. Within two months after notice to proceed by the Project Managers, or after execution of Owner/Contractor Agreement, submit a complete typed list of all ELECTRONICS equipment manufacturer's and materials suppliers for the equipment proposed to be provided on this project, as well as names of all subcontractors.

- C. Within four months after notice to proceed issued by the Project Managers, or after execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the Specification sections or Drawings number, and an item description. Prefix the submittal identification number by the Specification sections to which they apply. Indicate on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturer, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submissions, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.
- E. Review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments shall not relieve the Contractor from compliance with the full scope and requirements of the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- F. No part of the work shall be started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted and accepted as well as No equipment shall be procured nor delivered to the job site unless a shop drawing for the same has been submitted and accepted or approved or similar words.
- G. A minimum period three working days, exclusive of transmittal time, will be required in the Engineer's office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor in the scheduling of the work.

*****END OF SECTION*****

SECTION 16060

GROUNDING AND BONDING

PART 1 – GENERAL

1.1 DESCRIPTION

Provide grounding system in accordance with the Contract Documents.

1.2 QUALITY ASSURANCE

Utility company approval of service installation.

1.3 STANDARDS

American National Standards Institute (ANSI) :

ANSI/IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System Part 1: Nominal Measurements

National Fire Protection Association (NFPA)

Philippine Electrical Code (PEC): PEC (PART 1&2: 2000)

Underwriter's Laboratories, Inc. (UL):

- | | | |
|--------|---|--|
| UL 44 | - | Thermoset Insulated Wires and Cables |
| UL 83 | - | Thermoplastic Insulated Wires and Cables |
| UL 467 | - | Grounding and Bonding Equipment |

E. Utility company requirements

21. SUBMITTALS

Shop Drawings:

Showing the location of system grounding electrode connections and the routing of grounding electrode conductor.

Test Reports:

Certified test reports of ground resistance.

Certifications: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the certification that the material and installation is in

accordance with the drawings and specifications and has been properly installed.

1.5 FIELD TESTING

- A. Resistance testing of grounding rod system indicating maximum 2 ohms resistance to ground (except that it shall be 1 ohm maximum for telecommunications grounding system).

1.6 IDENTIFICATION

- A. Provide an identification nameplate for each ground bus cabinet.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Grounding connections shall be brazed molded exothermic welded, bolted clamp terminal, or pressure connector type.

2.2 GROUNDING WIRES

- A. General Purpose: UL and NEC approved types, copper, with TW, THW, XHHW or dual rated THHN-THWN insulation color identified green.
- B. Isolated Power System: Type XHHW insulation with a dielectric constant of 3.5 or less.
- C. Wire sizes not less than what is shown and not less than required by the NEC.

2.3 GROUNDING ELECTRODE SYSTEM

- A. Provide the following grounding electrodes, bonded together to form the grounding electrode system:
 - 1. Metal underground water pipe in direct contact with the ground for 3 meters or more and electrically continuous to the points of connection of the grounding electrode conductor and the bonding conductors.
 - 2. Grounding rod of copper clad steel, minimum 20 mm diameter, minimum 3 meters long, driven full length into the ground. If the maximum resistance to ground cannot be obtained with a single ground rod, provide additional ground rods installed not closer than 2

meters apart until the required maximum resistance to ground is obtained.

3. Other grounding electrodes as shown on the Drawings.

2.4 TELECOMMUNICATIONS GROUNDING SYSTEM

- A. Provide a continuous bare copper grounding conductor to each telecom terminal backboard and telecom terminal cabinet and racks. Bond the telecommunications grounding system to the grounding electrode system.

PART 3 – EXECUTION

3.1 GENERAL

- A. Ground in accordance with the PEC, as shown on drawings, and as hereinafter specified.
- B. Equipment Grounding: Metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.
 1. Metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded to the grounding system for personnel safety and to provide a low impedance path for possible ground fault currents. Non conductive paint, enamel, or similar coating shall be removed at threads and contact surfaces to preserve grounding continuity or fittings shall be provided to make such removal unnecessary.

3.4 GROUND RESISTANCE

- A. Grounding system ground resistance must not exceed to 2 ohms (1 ohm for telecommunication systems). Final tests shall assure that this requirement is met.
- B. Make necessary modifications to the ground electrodes for compliance that are needed without additional cost to the Owner, including the provisions of a multi rod system.

3.5 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth for not less than ten feet in depth. (If applicable)

- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly clean the joint.
- D. For compression connectors, use homogenous copper, anticorrosion, surface treatment compound at connectors in accordance with connector manufacturer's recommendations. Use connectors of proper size for conductors and ground rods specified. Use connector manufacturer's compression tool. Notify Engineer prior to back filling any ground connections.
- E. Grounding electrodes in horizontal trenches to achieve the specified resistance.

*****END OF SECTION*****

SECTION 16073

HANGERS AND SUPPORTS FOR ELECTRONICS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

Section includes:

Hangers and supports for electrical equipment and systems.
Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five (5) times the applied force.

1.3 SUBMITTALS

Product Data: For steel slotted support systems.

Retain first paragraph and subparagraphs below if supporting systems are required to withstand specific design loads and Architect either has delegated design responsibility to Contractor or wants to review structural data as another way to verify supporting system's compliance with performance requirements. Professional engineer qualifications are specified in Division 1 Section "Quality Requirements."

Shop Drawings: [Signed and sealed by a qualified professional engineer.] Show fabrication and installation details and include calculations for the following:

Trapeze hangers. Include Product Data for components.

Steel slotted channel systems. Include Product Data for components.

Equipment supports.

Welding certificates.

1.4 QUALITY ASSURANCE

Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

Comply with NFPA 70.

PART 2 – GENERAL

1.3 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 1 Section "Product Requirements."

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

Channel Dimensions: Selected for applicable load criteria.

- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron, hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of

conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

- B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. In first paragraph below, support spacings in NECA 1, Table 1, are more detailed and specific and generally stricter than those permitted by NFPA 70 for EMT, IMC, and RMC. Revise to suit Project, and consider retaining reference to NECA table for critical projects.
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC shall be 1200mm interval minimum. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Retain first paragraph below to permit raceways running perpendicular to bar joists and trusses to be supported by letting them rest within the joist or truss openings. NECA 1 does not mention this method. If seismic design requirements apply, consult structural engineer or authorities having jurisdiction before permitting this support method and specify seismic requirements.
- C. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- D. Strength of Support Assemblies: Where not indicated, select sizes of components so

strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electronics items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electronic materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section Cast-

in-Place Concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

*****END OF SECTION*****

SECTION 16075

FIRESTOPPING MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Only tested firestop systems shall be used in specific locations as follows:

Penetrations for the passage of duct, cable, cable tray, conduit, piping, and electronic raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

Opening and penetrations in fire-rated partitions or walls containing fire doors.

Opening around structural members, which penetrate floors or walls.

1.2 RELATED DOCUMENTS

All work specified in this Section is subject to the provisions of Section 16010.

Refer to the following sections of related work in connection with Firestopping:

16010 – Electronics Systems General Provision

16130 – Raceway and Boxes

C. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

D. All works specified in this Section is subject to Architectural Fire Compartmentation plans.

E. Fire stopping rating shall be as follows:

(Except as noted in fire life safety/architectural drawings). However, the more stringent applies:

Zone-to-Zone	2hrs
Floor-to-Floor	2hrs
Penetrations to External Wall	3hrs
Critical Zone within compartmentation	1hr
Penetrations to Lift stairwell shaft	2hrs

& duct chases

1.3 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of fire stop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Fire stop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.
- A. Fire stop Systems do not re-establish the structural integrity to load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- B. For those fire stop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation.

1.4 APPLICABLE PUBLICATIONS

- A. American Society for Testing and Materials (ASTM):

E 814 - Fire Tests of Through- Penetration Fire Stops
- B. Underwriters Laboratories, Inc. (UL):

UL 1479 - Tests for Fire Resistance of Building Joint Systems UL
2079 - Fire Tests of Through -Penetration Fire Stops

1.5 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL fire stop systems to be used and manufacturer's installation instructions.
- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor's name that will install fire stop system as described in

drawing.

- C. Submit material safety data sheets provided with product delivered to job-site.

1.6 MANUFACTURERS

A. Installer qualification

Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire stopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its fire stopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

- A. Provide fire stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire stopping under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.
- B. Provide components for each fire stopping system that are needed to install fill material. Use only components specified by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Fire stopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed". Provide cast-in-place fire stop devices prior to concrete placement.
- D. Use only fire stop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- E. Appropriate sealant shall be used in the following materials:
 - 1. Cast-in place fire stop devices for use with non-combustible plastic pipe (closed and open piping systems) penetrating concrete floors.
 - 2. Sealants or caulking materials for use with fire-rated construction joints and other gaps.

3. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps.
4. Intumescent sealants for caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PV jacketed, flexible cable or cable bundles and plastic pipe.
5. Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles.
6. Non curing, re-penetrable intumescent sealant, caulking or putty materials for use with flexible cable or cable bundles.
7. Wall opening protective materials for use with U.L listed metallic and specified non-metallic outlet boxes.
8. Firestop collar wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems).
9. Materials used for large size/complex penetrations made to accommodate cable trays and electronic raceways.
10. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, and electronic raceways.
11. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814, which is equal to the rating of construction being penetrated.
12. Provide a firestop system with an Assembly Rating as determined by UL 2079, which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 1. Verify penetrations are properly size and in suitable condition for application materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trade to provide adequate spacing of field runs pipes to allow for installation of cast-in-place firestop devices without interferences.

3.3 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 3. Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.6 CERTIFICATION

The Contractor shall secure certification from the Manufacturer (not distributor or supplier) that the Installation done by the Contractor is in conformance set by the U.L.

*****END OF SECTION*****

SECTION 16100

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

This Section, Basic Methods and Requirements (Electronics) applies to all sections of Division 16.

Furnish and install electronic wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of cable and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

References to the Philippine Electrical Code (PEC), Philippine Electronics Code (PECO), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) National Electrical Code (NEC) are minimum installation requirement standards.

Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Evidence of compliance shall include certified test reports and definitive shop drawings.

Definitions:

Listed; equipment or device of a kind mentioned which:

Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.

States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

Labeled; equipment or device is when:

It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.

The laboratory makes periodic inspections of the production of such equipment.

The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

3. Certified; equipment or product is which:

- a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
- b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
- c. Bears a label, tag, or other record of certification.

4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations.

1 QUALIFICATIONS (PRODUCTS AND SERVICES)

- B. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

C. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately fifteen (15) years unless noted otherwise.
2. The Owner reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

2 MANUFACTURED PRODUCTS

B. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

C. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

D. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

E. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

F. When Factory Testing Is Specified:

1. The Owner/Engineer shall have the option of witnessing factory tests. The contractor shall notify the Owner through the Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and reinspection is required, the contractor shall be liable for all additional expenses, including expenses of the Owner/Engineer.

1.6 EQUIPMENT PROTECTION

Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

- A. During installation, enclosures, equipment, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating if required.
- B. Damaged equipment shall be, as determined by the Engineer, be returned to the source of supply for repair or replacement.

1.7 WORK PERFORMANCE

- A. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 16010 - Electronics General Provisions.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the PECO.
- C. Inaccessible Equipment:

1. Where the Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.

1.9 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as cabinets and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4-inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

- A. The Owner's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not an approval from the engineer will not be permitted at the job site.
- B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Owner to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 3. Submit each section separately.
- D. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals:

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish eight copies, (One Original Copy), bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
 - a. Installation and maintenance instructions.
 - b. Safety precautions.
 - c. Diagrams and illustrations.
 - d. Testing methods.

- e. Performance data.
 - f. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the Engineer with one sample of each of the following:
- 1. Each type of conduit coupling, bushing and termination fitting.
 - 2. Conduit hangers, clamps and supports.
 - 3. Duct sealing compound.
- B. SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

*****END OF SECTION*****

SECTION 16130

RACEWAYS AND BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

Provide raceways and boxes in accordance with the Contract Documents.

1.2 STANDARDS

American Society for Testing and Materials (ASTM):

ASTM A 446 - Steel Sheet Zinc-Coated (Galvanized) by the Hot Dip Process,
Structural Physical Quality

ASTM A 525 - Steel Sheet Zinc-Coated, Galvanized by the Hot Dip Process

American National Standards Institute (ANSI): ANSI 61 -
Gray Enamel Finish Coat.

ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated.

ANSI/NEMA FB 1- Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and
Cable Assemblies

National Electrical Manufacturer's Association (NEMA):

NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

NEMA VE 1 - Metallic Cable Tray Systems

Philippine Electrical Code (PEC): PEC

2000 (PART 1:2000)

1.3 SUBMITTALS

Conduit, Boxes, Wireways, Manholes, Handholes and Auxiliary Gutters:

Manufacturer's product data sheets

Samples

Shop Drawings:

Size and location of cables. Size and location of panels and pull boxes. Layout or required conduit penetrations through structural elements.

The specific item proposed and its area of application shall be marked on the catalog cuts.

1.4 IDENTIFICATIONS

Mark junction box covers with permanent stencil identification of wiring contained within.

1.3 Paint fire alarm and life safety system boxes and conduits red.

PART 2 – PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Intermediate Metal Conduit:

1. Mild steel conduit, heavy wall, hot dipped galvanized inside and out, threaded ends.
2. ANSI/NEMA FB1 – Threaded type fittings.

B. Electrical Metallic Tubing:

1. ANSI C80.3; continuous, seamless steel tubing galvanized or sherardized on exterior, coated on interior with smooth hard finish of lacquer, varnish or enamel.
2. NEMA FB1; Steel, set screw or compression type fittings. Provide concrete type fittings where required.

C. Flexible Steel Conduit:

1. Single strip, continuous, flexible interlocked double-wrapped steel, hot dip galvanized inside and out forming smooth internal wiring channel.
2. NEMA FB 1; steel, compression type fittings.

D. Liquid Tight Flexible Conduit:

1. Same as flexible steel conduit except with tough, inert, watertight plastic outer jacket.
2. NEMA FB1; Fittings shall be cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings threaded to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon insulated throat.

E. Polyvinylchloride (PVC) Conduit:

1. Schedule 40 polyvinyl chloride suitable for 90°C.
2. Solvent cemented type fittings.
3. 20 mm. Minimum.

F. Cable Tray /Trunking/Ladder:

1. Cable raceway systems shall consist of straight sections, fittings, and required and classified as equipment grounding conductors. Provide radiused elbows, tees, crosses, splice plates, wall and overhead supports, and other fittings necessary for a complete, continuously grounded system.
2. Pre-Galvanized Steel: Straight sections and fitting siderails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A446, Grade A and mill galvanized in accordance with ASTM A525, Coating Designation G90. Splice plates shall be manufactured from high strength steel, using ribbed carriage bolts and serrated flange locknuts.
3. Ladder: Ladder type trays shall consists of two longitudinal members (siderails) with transverse members (rungs) welded to the siderails. Rungs shall be spaced 15 cm on center. Rung spacing in radiused fittings shall be 22 cm measured at the center of the trays width. Rungs shall have a minimum cable bearing surface of 20 mm with radiused edges. No portion of the rungs shall

protrude below the bottom plane of the siderails.

4. Trunking: Formed sheet steel, heavy duty type, powdered coated gray with rust proof finish. 1.6mm minimum thickness.

- G. Loading capacity shall meet include weight of cables installed plus a safety factor of 1.5

1 WIREWAYS AND AUXILIARY GUTTERS

- A Sizes and shapes as indicated and/or as required.

- 1.6 Provide necessary elbows, tees, connectors, adapters, etc.

- 1.7 Continuous removable cover secured with screws and keyhole slots. Hinged cover where installed above suspended ceiling.

- 1.8 Provide wire retainers at not greater than 30 cm on center. Outlet, Junction, and Pull Boxes

- 1.9 Cast Type Boxes: NEMA FB1

- A. Ferrous alloy box with inside threaded hubs for rigid steel conduit.
- B. Aluminum box with inside threaded hubs for rigid aluminum conduit.
- C. Ferrous alloy box with compression or inside threaded hubs with adapter for electrical metallic tubing.
- D. Cast raised cover, size matched to contour of box.
- E. Tapered threads for hubs.

- 1.10 Galvanized Pressed Steel Type Boxes: NEMA OS 1

- A. General:

1. Pressed steel, galvanized or cadmium-plated, 10 cm minimum octagonal or square with galvanized cover or extension ring as required.

- B. Lighting Fixture Box:

1. 10 cm minimum octagon.
 2. Where fixtures are mounted on or in an accessible type ceiling and a modular wiring system is not used, provide a junction box and extend flexible steel conduit to each fixture.
- A. Provide 10 mm bolt fixture studs where required. G. Sheet Steel Boxes: NEMA OS 1:
- a. No. 12 gauge sheet steel for boxes with maximum side less than 1 meter, and maximum area not exceeding 6,500 square cm; riveted or welded 20 mm flanges at exterior corners.
 - b. No. 10 gauge sheet steel for boxes with maximum side 1 meter to 1.5 meters, and maximum area 6,500 to 10,000 square cm; riveted or welded 20 mm flanges at exterior corners.
 - c. No. 10 gauge sheet steel riveted or welded to 40 mm x 40 mm x 6 mm welded angle iron framework for boxes with maximum side exceeding 1.5 meter and more than 10,000 square cm in area.
4. Covers:
- a. Same gauge steel as box.
 - b. Subdivided single covers so no section of cover exceeds 23 kg.
 - c. Machine bolts or machine screws threaded into tapped holes.
5. Paint:
- d. Rust inhibiting primer, ANSI 61 gray enamel finish coat.
 - e. Rust inhibiting primer ANSI 61 powder coated gray finish coat.

PART 3 – EXECUTION

1 GENERAL

- A Provide raceways for all systems. Complete runs before pulling in cables or wires. Provide insulated grounding conductor in metallic or nonmetallic raceways. Minimum conduit size shall be 15 mm. Wiring of each type and system shall be installed in separate raceways.
- B Protect metallic raceway in earth or fill from corrosion with two coats of corrosion resistant paint or tape wrap.

- C Elbows for the connection of an exposed steel conduit above grade to the conduit installed below grade or embedded within floor slabs shall be rigid steel conduit with two coats of corrosion resistant paint or tape wrap.
 - D Branch circuit conduits or wiring device conduits for miscellaneous systems shall not be installed below slab on grade or embedded within floor slabs in tenant areas.
 - E Locate raceways so that the integrity of structural members is not affected and they do not conflict with the services of other trades. Draw up couplings and fittings full and tight. Protect threads from corrosion after installation with zinc chromate or equivalent protection.
 - F Conceal raceways except at surface mounted cabinets and freestanding equipment. Provide flashing and counter-flashing for waterproofing of raceways which penetrate the roof. Route exposed raceways and raceways above suspended ceilings parallel or perpendicular to building lines with right angle turns and symmetrical bends. Provide sleeves in concrete walls, floor slabs and partitions. Waterproof sleeved raceways where required.
- 1 Provide raceway expansion joints for exposed and concealed raceways at expansion joints and between structures to compensate for differential movement. Provide bonding conductor.
 - 2 Provide one empty 20 mm inch raceway for each three spare unused poles or spaces of flush-mounted panel boards. Terminate conduit in an accessible location for future extension.
 - 3 Provide raceways with appropriate seal-offs, explosion-proof fittings, etc. in special occupancy areas as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling or floors which separate adjacent rooms having substantially different maintained temperatures, refrigeration, or cold storage rooms.
 - 4 Provide pull cord in empty raceways. Tag both ends noting destination.
 - 5 Clear raceway of all obstructions and dirt prior to pulling in wires or cables. Use ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt or similar material. This assembly may be pulled with, but ahead of cable being installed. Clean empty raceways similarly. Clear or replace

any raceway which rejects ball mandrel.

- 6 Secure raceway clamps or supports to masonry materials with toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.
- 7 Install exterior underground conduits 60 cm minimum below finished grade. Do not penetrate waterproof membranes unless proper seal is provided.
- 8 Raceways above Suspended Ceilings:
 - F. Single runs of 15 mm or 20 mm raceways may be supported from ceiling support wires where permitted by the rating of the ceiling system.
 - G. Provide independent support of raceways larger than 20 mm. Provide independent support of multiple raceways (more than one). Provide unistrut support and threaded rod to structure above. Attachment to ceiling support wires is not permitted.
 - H. Provide independent support of raceways installed above fire rated ceilings. Attachment to ceiling support wires is not permitted.
 - I. Install conduit 30 cm minimum above top of ceiling.
- 9 Conduit connected to rotating or vibrating equipment shall be flexible metal conduit or liquid tight flexible conduit.
- 10 Raceways Embedded in Floor Slabs:
 - F. Raceways shall not be installed in slab without the approval of the Structural Engineer.
 - G. Raceways shall not interfere with placement of floor slab reinforcement components.
 - H. Install raceways between the upper and the lower layers of reinforcing steel. Space raceways not less than 200mm on centers except where they converge at panels or junction boxes.
 3. Raceways running parallel to slabs supports, such as beams, columns and structural walls, shall be installed not less than 300mm from such supporting elements.

Q. Non Metallic Raceway Installations:

1. Joints shall be made using the material recommended by the raceway manufacturer. Components shall be cleaned prior to assembly.
2. Raceway cutoffs shall be square and shall not deform conduit. Ream rough surfaces.
3. Provide male box adapters to terminate raceways.
4. Where separable terminations are required, provide PVC threaded adapters with locknuts or bushings. Provide "O" rings for watertight installations.
5. Bends shall be made by methods that do not deform or damage the conduit.
6. Provide expansion fittings where required.
7. Raceway supports shall be installed to allow the non metallic conduit to slide through the supports.
8. Non metallic raceway is not permitted within the building.

R. Underground Services:

1. Provide underground Telco services as indicated. Provide concrete encasement of auxiliary systems duct banks except where duct banks run beneath building slab on grade. Provide concrete encasement of Telco raceway elbows for all systems. Provide steel reinforcing bars for concrete encased Telco service. Provide spacers to permit concrete to completely surround and encase each conduit. Concrete strength shall be 200 kgs/square meter. Provide red dye inhibiting agent in concrete mix.
2. Pitch conduit down and away where Telco raceway enters the building or equipment.
3. Support raceways installed in Telco raceway every 1.5 meters to assure correct alignment prior to placing concrete.
4. Terminate raceways with flared end bells. Clear raceway terminations of burrs and rough edges.

- S. Raceways and fittings installed in hazardous (classified locations shall conform to local electrical code requirements for the associated Class and Division.

3.2 WIREWAYS AND AUXILIARY GUTTERS

- A. Install wireways above suspended ceilings such that cover will hinge upward from

side.

- B. Provide 30 mm clear from wireway cover when in open position.

3.3 CABLE TRAY/TRUNKING/LADDER

- A. Cable Raceway shall be supported at a maximum of 1.5 meters on centers and at each bend, tee, cross, and elbow fitting. Supports shall be threaded rod trapeze style hangers or wall brackets. Side rails shall bear on the supports; rungs shall not bear on the supports.
- B. Cable Raceway shall be installed level. Manufactured offsets shall be used to change height or direction.
- C. Coordinate location of cable raceway with other trades to avoid conflicts and maintain accessibility. Where installed above a ceiling, cable trays shall be not less than 30 cm above the bottom of the finished ceiling. Vertical clearance above the tray shall be a minimum of 30 cm.
- D. Cable Raceway shall be continuous. Where cable raceway run is interrupted at a fire rated wall, provide three 10 cm sleeves in fire rated wall. Provide bonding jumpers where cable trays are interrupted at fire rated walls and floors or are otherwise rendered electrically discontinuous.
- E. Cable raceway installed in an environmental air plenum shall be solid bottom with continuous cover, rated for installation in an environmental air plenum.
- F. The thickness of material of metal trunking shall be as the following table:

Nominal Size (mm)	Min. Thickness of Body Material (mm)
50 x 50	1.0
75 x 50	1.2
75 x 75	1.2
100 x 75	1.2
100 x 100	1.4
150 x 100	1.4
150 x 150	1.6

250 x 150

1.8

Covers of the cable trunkings shall be of the quick fix pattern with center captive screw. Other fixing arrangement will not be accepted.

- G. Cable trunkings in vertical runs shall be fitted with pin racks inside the trunkings to support the weight of the cables, and to enable the cables to be secured during installation. These pin racks shall consist of steel pins sheathed with insulating materials and shall be mounted on backing-plates at intervals of 3 meters.
- H. Cable trunking shall be terminated with end flanges; which shall be bolted directly to distribution boards, or apparatus. Connecting pieces shall be used and bolted with cadmium-plated mushroom head steel screws, nuts and vibration resistant locking washers.
- I. Each trunking joint shall have a tinned copper bond bolted to each adjacent trunking to ensure electrical continuity.

3.4 OUTLET, JUNCTION, AND PULL BOXES

- A. Provide outlet, junction, and pull boxes as indicated and as required for a complete installation and to facilitate proper pulling of wires and cables. Boxes shall be sized per electrical code as minimum. Plug open knock outs.
- B. The exact location of outlets and equipment is governed by field conditions. Where necessary, relocate outlets so that fixtures and equipment are symmetrically located in accordance with the room layout and will not interfere with other work or equipment. Verify final location of outlets, fixtures, and equipment with Architect.
- C. Back-to-back outlets in the same wall, or "through-wall" type boxes are not permitted. Provide 30 mm minimum spacing for outlets shown on opposite sides of a common wall. Provide acoustical potting compound on outlet boxes installed in private offices and conference rooms.
- D. Fit outlet boxes in finished ceilings or wall with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use multiple gang boxes and covers. Provide tile box or a 10 mm square box with tile ring in masonry walls not plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of type and size suitable for the specific application. Provide barriers where required for voltage or systems separation.
- E. Provide pull boxes so that an individual run of conduit does not contain more than the equivalent of 4 ninety degree bends (360 degrees total).
- F. All boxes and conduit accessories shall be fully weather-proof when used in outdoor

locations; weatherproof boxes and conduit accessories shall also be used in locations other than outdoors when so specified on the Drawings.

- G. Provide nameplate/identification

3.5 APPLICATION OF RACEWAYS

A. Intermediate Metal Conduit

1. Where exposed to physical damage.
2. Indoors where exposed to moisture.
3. Where required by code.
4. Exposed indoor installations within 3000mm above finished floor.
5. Exposed outdoor installations.
6. General purpose auxiliary systems, telephone system except where another conduit type is specifically required.

B. Electrical Metallic Tubing:

1. General purpose feeders and branch circuits, except where another conduit type is specifically required.

C. Wireways and Auxiliary Gutters:

1. Where indicated
2. Above and below panel boards, lighting relay cabinets, and terminal cabinets to accommodate large concentrations of wires.

D. Cable Trays/Trunking/Ladder:

1. Low Voltage Feeders
2. Medium Voltage armored cable feeders.
3. Exposed and accessible locations shall be solid bottom type cable tray.
4. Communication System

G. Polyvinylchloride (PVC) Conduit

1. Underground duct banks
2. Below slab on grade
3. Embedded in floor slabs

3.6 APPLICATION OF BOXES OUTLET, JUNCTION AND PULL BOXES

A. Cast Type Boxes:

1. Where connected to rigid steel, intermediate metal, rigid aluminum conduit and liquid tight flexible conduit, 30 mm and smaller.
2. Exposed conduit installations within 3 meters above finished floor.
3. Where exposed to moisture and outdoors.

B. Galvanized Pressed Steel Type Boxes:

1. Where connected to electrical metallic tubing and flexible steel conduit, 30 mm and smaller.
2. Dry locations.
3. Where concealed in walls and above suspended ceilings.

C. Sheet Steel Boxes:

1. Where connected to conduit larger than 32 mm Ø.

3.7 SLEEVES

- A. Sleeves shall be 10 cm rigid steel nipples. Extend floor sleeves a minimum of 10 cm above and below finished floor. Extend wall sleeves a minimum of 10 cm on either side of wall. Sleeve ends shall be threaded.
- B. Provide sleeves between floors of telecommunication closets as in quantities and locations shown on the Drawings.
- C. Fire seal floor sleeves and sleeves in fire rated walls to maintain fire rating of wall after telephone cables is installed.

*****END OF SECTION*****

SECTION 16711

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

The Contractor shall furnish and install the complete structure cabling system as detailed on the drawings and described in this specification.

1.2 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only:

1.2.1 American National Standard Institute (ANSI);

1.2.2 Electronics Industry Association/Telecommunications Industry Association (EIA/TIA)

1.2.3 National Electrical Manufacturer's Association (NEMA);

1.2.4 Institute of Electrical and Electronics Engineers (IEEE);

1.2.5 International Standards Organizations (ISO/IEC 11801);

1.2.6 Rural Electrification Administration (REA);

1.2.7 Insulated Cable Engineers Association (ICEA)U;

1.2.8 Underwriter's Laboratory (UL);

1.2.9 National Fire Protection Association (NFPA);

1.2.10 Philippine Electrical Code (PEC); and

1.2.11 National Electrical Code (NEC).

1.3 RELATED SECTION:

1.3.1 Section 16402: Interior Wiring System

1.4 SUBMITTALS:

1.4.1 The Contractor shall submit the following for approval.

- a. Technical data of system components;
- b. Work station outlet, cable and related accessories;
- c. Network Diagram / System layout.

1.4.2 The Contractor shall provide three (3) sets of the following, upon turn-over:

- a. Operation Manual;
- b. Test Reports; and
- c. As-Built Plans.

1.5 WARRANTY AND GUARANTEE

The Contractor shall provide system performance guarantee and product warranty for fifteen-year from the date of final acceptance.

1.6 SYSTEM OPERATION:

1.6.1 The system shall support voice USOC, AT&T, Northern Telecom, NEC, IC6, 15DN, MITEC, and to support current application such as TP-PMD, 100Base-T, ATM 622Mbps, and 1000Base-T.

PART 2 - PRODUCT

2.1 GENERAL

Specifications are intended to describe the requirements of Structured Cabling System.

2.2 HORIZONTAL SYSTEM:

2.2.1 Horizontal cable: Horizontal cable shall be 100Ω, 4 pairs, Category 6, Unshielded Twisted Pair (UTP), 0.51mm (AWG 24), solid bare copper wire, polyethylene insulated, PVC jacketed, and CMR flame rated. Cable shall have the following transmission characteristics:

Frequency (MHz)	Attenuation Maximum (dB/100m)	Minimum PS- NEXT (dB)	Minimum PS-EL FEXT (dB)
100	18.6	41.8	25

2.2.2 WORK STATION OUTLET

Workstation outlet shall be Category 6, UTP, 568A, RJ45, with the following electrical characteristics at 200MHz.

- a. NEXT - $\geq 48\text{dB}$
- b. FEXT - 37dB ; and
- c. Attenuation - 0.2dB .

Constructed from high impact, flame retardant thermoplastic with color-coded snap-in identification

2.3 MAIN & INTERMEDIATE DISTRIBUTION FRAME (MDF & IDF)

The distribution frame shall link the horizontal system & backbone system together. It shall be composed of a combination of a free-standing data cabinet and a wall-mounted data cabinet. Each cabinet shall have patch panels, terminal block, cross connection wires, patch cord, and cable management system.

2.3.1 Cable Management Rack

Cable management rack shall be standard EIA 19" X 6 ft floor mounted rack. Rack shall include vertical cable managers mounted on the channels with removable covers that can handle large quantities of cables and patch cords.

2.3.2 Copper Patch Panel

Patch panel shall have Category 6 electrical performance. Patch panel shall be made of black anodized aluminum 24/48 ports, TIA 568B, ANSI/TIA-568.2-D-2018 Standard.

2.3.3 Telephone/EPABX terminal Block

Terminal block shall be rack mounted with number pair as indicated on the plans. Terminal block shall be color coded to TIA 568B.2-1.

Mechanical Characteristic jack connector

Operating life	200 cycles punches down
Contact materials	Grade A copper alloy
Contact plating	Tin/Lead
Wire accommodation	Top contact 2 x 22-26 AWG solid/stranded Bottom contact 1 x 22-26 AWG solid/stranded
Pitch	3.81 mm
NEXT	better than -53dB @ 100 MHz
Attenuation	<0.001 dB @ 100 MHz
Termination type	Gas-Tight insulation displacement
Resistance Insulation	500 megaohms
Termination	<0.5 milliohms

2.3.4 Cross Wire & Patch Cord

Cross connection wire and patch cord shall meet or exceed the same category rating of connecting hardware.

2.4 BACKBONE CABLING:

2.4.1 TELEPHONE CABLE

Telephone cable shall conform to REA-PE-39 for underground installation and REA-PE-22 for above ground installation, sizes shall be as indicated on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 Horizontal cable

All horizontal cables shall not exceed ninety 90 meters from the Main/Intermediate Distribution Frame.

- 3.1.2 Patch Cord and Equipment Cable: The total length of patch cord and equipment cable shall not exceed ten (10) meters.
- 3.1.3 Work Area Termination: All UTP cables wired to the telecommunications outlet/connector should have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated. The telecommunications outlet/connector shall be securely mounted at planned locations. The height of the telecommunications faceplates shall be to applicable codes and regulations.
- 3.1.4 Pulling Tension: The maximum cable pulling tensions shall not exceed manufacturer's specifications.
- 3.1.5 Bend Radius: The maximum cable bend radii shall not exceed manufacturer's specifications. In spaces with UTP cable terminations, the maximum bend radius for 4-pair cable shall not exceed four times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications. During the actual installation, bend radius on 4-pair cable shall not exceed eight times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.
- 3.1.6 Slack: In the work area, a minimum of 300 mm should be left for UTP, while 1 m (3 ft) be left for fiber cables. In telecommunications room/closets a minimum of 3 m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.
- 3.1.7 Cable Tie Wraps: Tie wraps shall be used at appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath. Hook and loop cable managers should be used in the closet where reconfiguration of cables and terminations may be frequent.
- 3.1.8 Grounding: The system shall be properly grounded.
- 3.1.9 Label: All system components shall be properly labeled and coordinated with the plans.
- 3.1.10 Workmanship: All work shall be done in a workman like fashion of the highest

standards in the telecommunications industry. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed. Workers must clean any debris and trash at the close of each workday.

3.2 TESTING:

3.2.1 Testing Procedures: Testing of cable channels shall be performed prior to system cut over.

3.2.2 Copper Testing: All proposed Category 6 field-testing should be performed with an approved level III UTP field test device. All installed channels shall perform equal to or better than the minimum requirements as specified by the table below.

Worst Case Channel Performance at Highest Frequency

Parameters	Category 6
Insertion Loss	1-250 MHz
NEXT Loss	33.7 dB Power
Sum NEXT Loss	33.1 dB
ELFEXT	30.2 dB
Power Sum ELFEXT	15.3 dB
Return Loss	8.0 dB
Propagation Delay	480 ns Delay
Skew	30 ns
ACR	0 dB
Power Sum ACR	0 dB

*****END OF SECTION*****

SECTION 16720

FIRE DETECTION AND ALARM SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

The requirements of the Contract Documents, including the General and Supplementary General Condition and Division 1 - General Requirements shall apply to the work of this section.

At the time of bid, all exceptions taken to these Specifications, all variances from these Specification and all substitutions of operating capabilities or equipment called for in these Specification shall be listed in writing and forwarded to the Engineer. Any such exception, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

1.2 SCOPE

The work covered by this Section of the Specification shall include all labor, equipment, materials and services to furnish and install a complete fire alarm system of the zoned, non-coded type. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer. The Addressable system shall consist of, but not be limited to, the following:

- a) Fire alarm control panel.
- b) Manual fire alarm stations.
- c) Smoke detectors.
- d) Heat detectors.
- e) Audible notification appliances; bells, horns, chimes.
- f) Visual notification appliances; strobes.
- g) Stair pressurization system startup control.
- h) Battery standby.

1.3 APPLICABLE CODES AND STANDARD

All equipment shall be UL listed for its intended use.

NFPA Standards 72

The National Electric Code.

Philippine Electronics Code (PELC) Book2

All other local codes and authorities having jurisdiction

1.4 RELATED DOCUMENTS

Secure permits and approvals prior to installation.

Prior to commencement and after completion of work notify Authorities Having Jurisdiction.

Submit letter of approval for installation before requesting acceptance of system.

1.5 RELATED WORK

The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:

- a) Sprinkler waterflow and supervisory switches shall be furnished and installed by the fire protection contractor.
- b) Elevator recall control circuits to be provided by the elevator control equipment.

1.6 SUBMITTALS

Provide list of all types of equipment and components provided.

Provide description of operation of the system, similar to that provided in Part 2 of this Section of the Specifications, to include any and all exceptions, variances or substitutions listed at the time of bid.

Provide manufacturer's printed product data, catalog cuts and description of any special installation procedures.

Provide samples of various items when requested.

Provide shop drawings as follows:

- a) Drawing of the fire alarm control panel.
- b) Single line riser diagram showing all equipment and type, number and size of all conductors.

1.7 WARRANTY

Manufacturer shall guarantee the system equipment for a period of one (1) year from date of final acceptance of the system.

The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

Upon completion of the installation of fire alarm system equipment, the electrical contractor shall provide to the architect a signed written statement, substantially in form as follows: "The undersigned, having engaged as the Electrical Contractor on the _____ confirms that the fire alarm system equipment was installed in accordance with the wiring diagrams, instructions and directions provided to us by the manufacturer."

PART 2 – PRODUCTS

2.1 CIRCUITING GUIDELINES

Each addressable analog loop shall be circuited as shown on the drawings but device loading is not to exceed 80% of loop capacity in order to leave for space for future devices. The loop shall have Class B operation.

Where it is necessary to interface Addressable initiating devices provide intelligent input modules to supervise Class B zone wiring.

For Addressable zone annunciation at the control panel zones shall be as shown on the zoning schedule, but shall be typically as follows:

- a) Manual Fire Alarm Stations : Provide one (1) alarm zone for each floor.
- b) Smoke Detectors: Provide one (1) alarm zone for each wing

Each of the following types of alarm notification appliances shall be circuited as shown on the drawings but shall be typically as follows:

- a) Audible Signals: Provide one (1) notification appliance circuit for each floor, each NAC connected to a remote signal module.
- b) Visual Signals: Provide one (1) notification appliance circuit for each 3.4 A of signal load connected direct to the control panel NACs, and 1.7A of signal load for each NAC connected to a remote signal module.

Each of the following types of remote equipment associated with the fire alarm system shall be provided with a form 'C' control relay contact as shown on the drawings, but shall be typically as follows:

- a) Pressurization Fans: Provide one control relay contact for each pressurization fan.

2.2 FIRE ALARM SYSTEM SEQUENCE OF OPERATION

The system shall identify any off normal condition and log each condition into the system database as an event.

- a) The system shall automatically display on the control panel Liquid Crystal Display the first event of the highest priority by type. The priorities and types shall be alarm, supervisory, trouble, and monitor.
- b) The system shall have a Queue operation, and shall not require event acknowledgment by the system operator. The system shall have a labeled color coded indicator for each type of event; alarm - red, supervisory - yellow, trouble - yellow, monitor - green. When an unseen event exists for a given type, the indicator shall flash. When all events of a given type have been displayed, the indicator shall change from flashing to steady.
- c) For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 40 character custom user description.
- d) The user shall be able to review each event by simply selecting scrolling keys (up-down) for each event type.
- e) New alarm, supervisory, or trouble events shall sound a silence able audible signal at the control panel.

Operation of any alarm initiating device shall automatically:

- a) Update the control/display as described above. Visually annunciate the zone of alarm on the panel's LCD display. The visual indication shall remain on until the alarm condition is reset to normal.

- b) Sound alarm signals in the area of alarm at the evacuation rate and the floor directly above and below. Operation of a general alarm key station shall cause all signals to sound evacuation.
- c) Turn on strobe lights in the area of alarm and the floor directly above and below.
- d) Operate control relay contacts to start the stairwell pressurization fan system.
- e) Operate control relay contacts to return all elevators that serve the floor of alarm initiation to the ground floor. If the alarm originates from the ground floor, operate control circuits contacts to return all elevators to the floor above or to a level as directed by the local fire department.

2.3 SUPPORT FOR INSTALLER AND OWNER MAINTENANCE

Provide a coded one man walk test feature. Allow audible or silent testing. Signal alarms and troubles during test. Allow receipt of alarms and programmed operations for alarms from areas not under test.

Provide internal system diagnostics and maintenance user interface controls to display/report the power, communication, and general status of specific panel components, detectors, and modules.

Provide loop controller diagnostics to identify common alarm, trouble, ground fault, Class A fault, and map faults. Map faults include wire changes, device type changes by location, device additions/deletions and Addressable open, short, and ground conditions. Ground faults on the circuit wiring of remote module shall be identified by device address.

Allow the user to disable/enable devices, zones, actions, timers and sequences. Protect the disable function with a password.

Allow the user to activate/restore outputs, actions, sequences, and simulate detector smoke levels.

Allow the service user to enter time and date, reconfigure an external port for download programming, initiate auto programming and change passwords. Protect these functions with a password.

2.4 EQUIPMENT

A. Fire Alarm Control Panel

The fire alarm control panels shall be "Quick Start" series and shall incorporate all control electronics, relays, and necessary modules and components in a semi-flush mounted cabinet. All control modules shall be labeled, and all zone locations shall be identified. The cabinet shall be steel, with a gray finish. The assembly shall contain a base panel, system power supply and battery charger with optional modules suitable to meet the requirements of these specifications.

System circuits shall be configured as follows: Addressable analog loops Class B; Initiating Device Circuits Class B; Notification Appliance Circuits Class B.

The system shall be supervised, site programmable, and of modular design with expansion modules to serve up to 125 detectors and 125 remote modules, and two notification appliance circuits (NACs) convertible to power risers to serve remote multiple NAC modules for zoned signal applications.

The system shall store all basic system functionality and job specific data in non-volatile memory. The system shall survive a complete power failure intact.

The system shall have built-in automatic system programming to automatically address and map all system devices and provide a minimum default single stage alarm system operation with support of alarm silence, trouble silence, drill, lamp test, and reset common controls.

The system shall allow down loading of a job specific custom program created by system application software. It shall support programming of any input point to any output point. The system shall support the use of Bar Code readers to assist custom programming functions. It shall allow authorized customization of fundamental system operations using initiating events to start actions, timers, sequences and logical algorithms.

The system shall support distributed processor intelligent detectors with the following operational attributes; integral multiple differential sensors, automatic device mapping, electronic addressing, environmental compensation, pre-alarm, dirty detector identification, automatic day/night sensitivity adjustment, dual normal/alarm LEDs, relay bases, and isolator bases.

The system shall use full digital communications to supervise all addressable loop devices for placement, *correct location*, and operation. It shall allow swapping of "same type" devices without the need of addressing and impose the "location" parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.

All panel modules shall be supervised for placement and return trouble if damaged or removed.

The system shall have a CPU watchdog circuit to initiate trouble should the CPU fail.

The system evacuation signal rate shall be continuous.

The system program shall meet the requirements of this project, current codes and standards, and satisfy the local Authority Having Jurisdiction.

Passwords shall protect any changes to system operations.

The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 4A continuous for notification appliance circuits. The power supply shall be capable of providing 10A to output circuits for a maximum period of 50 ms. Auxiliary power shall be 24 Vdc at 500 mA. All outputs shall be power limited. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 5 minutes.

The LCD Display Module shall be of membrane style construction with a 14 line 224 character Liquid Crystal Display. The LCD shall use supertwist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill, and one custom programmable key/indicator. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program,

and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.

2.5 COMPONENTS

2.5.1 Intelligent Devices – General

Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, number of alarms and troubles, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.

Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and *supervision by location*. Setting a device's address by physical means thru dip switch or rotary switch shall not be acceptable.

2.5.2 SINGLE INPUT MODULE, SIGA-CT1

Provide intelligent single input modules SIGA-CT1. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)

2.06.c.4 Waterflow/Tamper Module, SIGA-WTM

Provide intelligent waterflow/tamper modules SIGA-WTM. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch.

2.06.c.5 Single Input Signal Module, SIGA-CC1

Provide intelligent single input signal modules SIGA-CC1. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation (Audible or Visible Signal Power Selector)

2.06.c.7 Control Relay Module, SIGA-CR

Provide intelligent control relay modules SIGA-CR. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

2.5.3 FIRE ALARM INITIATING DEVICES – GENERAL

All initiating devices shall be UL Listed for Fire Protective Service.

All initiating devices shall be of the same manufacturer as the Fire Alarm Control Panel specified to assure absolute compatibility between the devices and the control panels, and to assure that the application of the initiating devices is done in accordance with the single manufacturer's instructions.

Any devices that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

2.5.4 NOTIFICATION APPLIANCES – GENERAL

All appliances shall be UL Listed for Fire Protective Service.

All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Accessibility Guidelines (ADA(AG)), and shall be UL 1971, and ULC S526 Listed.

All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.

Temporal Horn/Strobes, 757 Series

The horn/strobe shall have a red plastic housing. Horn/strobes shall be selectable for high or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible. A synchronized temporal pattern sound output level of 97 dBA average shall be provided.

The strobe shall provide 15/75 cd synchronized flash outputs. The strobe shall have lens markings oriented for wall mounting. Removal of a installed Horn/Strobe to change the lens markings shall not be acceptable.

PART 3 – EXECUTION

3.1 INSTALLATION

The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department, and shall be installed in rigid, threaded conduit throughout.

All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.

End of Line Resistors shall be furnished as required for mounting as directed by the manufacturer.

The system shall be arranged to receive power from one three wire 220 Vac, 15 A supply. All low voltage operation shall be provided from the fire alarm control panel.

3.2 FIELD QUALITY CONTROL

The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all of the function as specified.

3.3 TESTS

Reports of any field testing during installation shall be forwarded to the Engineer.

Each individual system operation on a circuit by circuit basis shall be tested for its complete operation. The procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Engineer and the manufacturer.

3.4 DOCUMENTATION AND TRAINING

The contractor shall compile and provide to the owners three (3) complete manual on the completed system to include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams and a manufacturer's suggested spare parts list.

In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of four (4) hours to instruct the owners' designated personnel on the operation and maintenance of the entire system.

***** END OF SECTION *****

SECTION 16761 INTERCOM SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Section 16011, "Intercom System", applies to this section, with the additions and modifications specified herein.

1.2 DESCRIPTION OF WORK

The work includes supply and installation of complete paging system but not limited to Switchboards, handsets, call points and related accessories.

1.3 SUBMITTALS:

1.3.1 **Manufacturer's Data:** Submit manufacturer's data for all materials and equipment to be incorporated in the work, as follows:

- a. Master Switchboard;
- b. Handset sub-stations;
- c. Power supply,
- d. Call extension points,
- e. Door Extension points;
- f. Ceiling Speaker;
- g. Add-on selector;
- h. Desk Top Microphone; and
- i. Other equipment necessary to complete the intercom system

1.3.2 **Shop Drawings:** Submit shop drawings for the overall system and for each major component. Drawings shall illustrate how each item of equipment will function in the system and shall include an overall system schematic indicating relationship of intercommunication units on one diagram.

1.3.3 **Operating and Maintenance Instructions:** Six bound sets of instructions for operating and maintenance shall be furnished.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND COMPONENTS

Equipment and components of program distribution and intercom systems shall conform to applicable requirements of Article 810, NFPA 70. The system shall be an integrated design of a single manufacturer and shall consist of Switchboards, handsets, call points, related accessories, and interconnecting cables complete with mount and supports.

2.1.1 Provide power supply either separately or as an integral part of Power supply. If separate, it shall be completely self-contained, requiring only a

240 VAC power source.

Hard-wired and Wireless Intercoms.

- a. Connected by cables, typically used in buildings, offices, and manufacturing facilities
- b. Use radio frequency (RF) transmission.

PART 3 - EXECUTION

3.1 INSTALLATION:

- 3.1.1 Plan layout: Determine the location for the master switchboard and sub-stations. Plan the cable routes, ensuring minimal interference and easy access.
- 3.1.2 Backboxes: Provide backboxes having characteristics suitable for power supply in them.
- 3.1.3 Mobility: System sub-assemblies shall be capable of relocation by running new cables to applicable junction box, patch-board or control unit.

3.2 FIELD TESTS

Conduct testing specified herein in the presence of the Owner.

- 3.2.1 Intercommunication System Tests: An operational system test shall be performed to verify conformance of intercommunication system to this specification. The Contractor shall notify the Owner two (2) weeks prior to when tests are to be performed so that Owner shall witness tests. These tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or non-designated units.
- 3.2.2 Re-testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense.

3.3 INSPECTION

Make observation to verify that units and controls are properly labeled, and interconnecting wires and terminals identified. Owner shall observe system features specified.

PART 4 – MEASUREMENT & PAYMENTS

Measurement shall be based on the actual quantity consumed/ installed and in accordance with the units specified hereunder:

Pay Item No.	Description	Unit
1.	Conduit (specify size and type)	lm

2.	Wires and cables (specify size and type of insulation)	lm
3.	Octagonal boxes	ea.
4.	Intercom equipment (please provide equipment breakdown)	set/s
5.	Miscellaneous consumables	lot
6.	Fittings and supports	lot
7.	Testing and commissioning	lot
8.	Others (please specify)	

Payments shall be based on the actual quantity consumed/ installed times the contract unit price which price constitutes full compensation including materials, labor, tools, installation equipment and incidentals necessary to complete this work.

*****END OF SECTION*****

SECTION 16990

TESTING AND COMMISSIONING OF ELECTRONICS SERVICES

PART 1 – GENERAL

1.1 SCOPE OF WORK

Provide any materials, equipment and labor required, and make such tests as specified in the various Electronics Systems and Communication Systems as specified herein, and as otherwise deemed necessary to show proper execution of the work in the presence of the Architect/Engineer.

Any defect or deficiencies discovered as result of such tests shall be corrected without additional cost to the Owner.

After the installation is completed and properly adjusted, operating tests shall be conducted. The various equipment and systems shall be demonstrated to operate in accordance with the requirements of the Contract Documents. Tests shall be performed in the presence of the Architect/Engineer. Provide electric power, instruments and personnel necessary for performing the various tests.

Procedures and tests outlined below are to be considered as in addition to normal visual and mechanical inspections which must be carried out prior to balancing equipment in service.

Procedures and test outline below are to be considered as in addition to tests called for under other sections of the electrical specifications.

Perform testing in the presence of the Architect/Engineer.

1.2 TESTING, SPECIAL REQUIREMENTS

The contractor shall take every precaution possible to assure the proper functioning of equipment or systems, and shall adhere to the following procedures.

Electronics equipment delivered to job-site during construction shall be protected in such a way that will prevent dirt, dust, water or any other foreign materials from entering or contaminating the working parts. This protection shall also be provided after installation as long as construction operations continue.

Before any equipment or system is energized, the following procedures and tests should be followed and/or performed.

Clean all dirt, dust and moisture from equipment.

Check for loose bus and cable connections.

Check for missing insulation in equipment and on conductors.

- d. Check for any modifications, alternations, or the use of unapproved parts in the assembly of the equipment against the approved submittals.
- e. The equipment room or area should be free of moisture accumulations.

1.3 SUBMITTALS

- A. Submit and provide a detailed drawing and coordination study of the electronics system.

1.4 SAFETY AND PRECAUTIONS

- A. Safety practices shall included but are not limited to the following requirements:
 - 1. Local Authority and Insurance Company's Standards/Requirements.
 - 2. Applicable National and Local Safety operating procedures.
 - 3. Owner's safety practices.
- B. In all cases, work shall not proceed until it has been determined that it is safe to do so.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

3.1 TESTING, ADJUSTING AND VERIFICATION

- A. Provide necessary material, labour and miscellaneous services for handling equipment during the testing, adjusting and verification procedure.
- B. Confirm that all device function properly.
- C. Witness tests shall occur in locations to be determined once manufacturers have been agreed with the successful electronics sub-contract renderer.
- D. Provide factory witness testing to suit delivery schedule of manufacturers. Provide hourly rates etc. to re-witness equipment if initial tests fail.
- E. Provide all submission and final report as previously specified.

Complete studies and reports shall be submitted simultaneously to the Engineer as well as part of the requirement of the Project Record Document.

3.2 BUILDING DISTRIBUTION SYSTEM

- A. Before energizing any portion of the electronics systems perform testing or checking on all cables. Result to conform to the applicable Codes and Standards to the satisfaction of the authorized inspection authority and to the Electronics Engineer.
- B. All devices to be tested on site prior to energizing, to ensure proper operation provided by equipment suppliers. Complete report to be submitted to the Electronics Engineer within seven (7) days of completion of testing.

3.3 SYSTEM

The following systems and equipment are to be tested, inspected and certified.

- A. Auxilliary Systems

3.4 COMMISSIONING

- A. The Contractor shall be responsible for the coordination of all the previously described elements which comprise the whole installation.
- B. In addition, the Contractor shall carry out final settings and adjustments and commissioning of the whole installation in accordance with the manufacturer's recommendations and recognized practice.
- C. Details of proposed commissioning procedures shall accompany the Contractor's proposal Submission.

*****END OF SECTION*****

