

(NOTE TO DESIGNER: These Specifications are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer.)

SECTION 27 05 43
UNDERGROUND DUCTS AND RACEWAYS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of exterior telecommunications pathways as called for in these specifications and related drawings.
- B. This section includes minimum requirements and installation methods for the following:
 - 1. Cutting and Patching Asphalt and Concrete
 - 2. Trenching and Excavation
 - 3. Underground Conduit Systems
 - 4. Cable Routing Hardware
 - 5. Horizontal Directional Drilling – Also commonly referred to as Directional Boring or Guided Horizontal Boring

1.2 SUMMARY *(Designer to provide a detailed summary of all work to be performed; examples below.)*

- A. Incoming Service Duct-bank: The connection point for telecommunications services is an existing maintenance hole located northwest of the project site. The project shall provide four (7) 4" PVC Schedule 40 conduits, with pull-rope in each PVC conduit, direct-buried from the Community Center MDF to the existing telecommunications service maintenance hole. (Refer to the Telecom Site Plan for details).
- B. Primary Duct-bank: The primary telecommunications duct-bank will consist of ten (10) 4" PVC Schedule 40 conduits from the Community Center MDF to a series of five (5) telecommunications maintenance holes located throughout the site. Each PVC conduit shall include pull-rope. (Refer to the Telecom Site Plan for details).
- C. Feeder Duct-bank: Each residential building shall be fed from the nearest telecommunications maintenance hole via two (2) 4" PVC Schedule 40 conduits. Each PVC conduit shall include pull-rope. (Refer to the Telecom Site Plan for details).
- D. Innerduct: Install three (3) - 3x3" Multi-cell flexible innerduct into each of the 4" conduits. All pull cords shall be secured at each end to prevent accidental removal.

1.3 RELATED DOCUMENTS

- A. Section 01 10 00 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.
- B. Section 01 20 00 - Price and Payment Procedures: Applications for payment, Schedule of Values, modifications procedures, closeout procedures.
- C. Section 01 30 00 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- D. Section 01 35 15 - LEED Certification Procedures.
- E. Section 01 40 00 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

- F. Section 01 57 13 - Temporary Erosion and Sedimentation Control.
- G. Section 01 57 21 - Indoor Air Quality Controls: Procedures and testing; smoking room testing; LEED requirements.
- H. Section 01 60 00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- I. Section 01 70 00 - Execution Requirements: Examination, preparation, and general installation procedures; pre-installation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.
- J. See Section 01 74 19 - Construction Waste Management and Disposal.
- K. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.
- L. Section 01 79 00 - Demonstration and Training: Detailed requirements.
- M. Section 01 91 13 - General Commissioning Requirements.
- N. Section 27 05 00 Basic Communications Requirements.
- O. Section 27 05 26 Grounding and Bonding for Communications Systems.
- P. Section 27 05 28 Pathways for Communications Systems.
- Q. Section 27 05 53 Identification for Communications Systems.
- R. Section 27 13 00 Backbone Cabling Requirements

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.5 QUALITY ASSURANCE

- A. All installation work for the new exterior telecommunications pathways shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of Owner.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval based on submittals provided.
- C. Materials and work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/NFPA 70 – National Electrical Code including, but not limited to, the following articles:
 - a. 314 – Outlet, Device, Pull-Boxes; Conduit Bodies; Fittings; and Vaults
 - b. 344 – Rigid Metal Conduit: Type RMC
 - c. 352 – Rigid Nonmetallic Conduit: Type RNC
 - d. 358 – Electrical Metallic Tubing: Type EMT
 - e. 384 – Strut-Type Channel Raceway
 - 2. IEEE/NESC – National Electrical Safety Code
 - 3. NEMA Standards including, but not limited to:
 - a. NEMA, RN1, 1986 PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - b. NEMA, TC3, 1982 PVC Fittings for use with Rigid PVC Conduit and Tubing.
 - c. NEMA, TC6, 1983 PVC and ABS Plastic Utilities Duct for Underground Installation.
 - d. NEMA, TC8, 1983 Extra Strength PVC Plastic Utilities Duct for Underground

- Installation.
 - e. NEMA, TC9, 1983 Fitting for ABS and OVC Plastic Utilities Duct and Fittings for Underground Installation.
 - f. NEMA, TC10, 1983 PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.
 - 4. UL Standards including, but not limited to:
 - a. UL 6, 1981 Rigid Metal Electrical Conduit
 - b. UL 651 1981 Schedule 40 and 80 PVC Conduit
 - 5. ANSI-C80.2, 1983 Specification for Rigid Steel Conduit, Enameled
 - 6. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 7. ANSI/TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications
 - 8. ANSI/TIA/EIA-758-A – Customer Owned Outside Plant Telecommunications Cabling Standard (including all applicable addenda)
 - 9. BICSI Telecommunications Distribution Methods Manual
 - 10. BICSI Customer-Owned Outside Plant Manual
- D. For horizontal directional drilling, the Contractor shall follow all procedural precautions necessary to ensure that the essential aspects of proper directional bore installation are adequately controlled.
- E. Personnel for horizontal directional drilling shall be fully trained in safety and their respective duties as part of the directional drilling crew.

1.6 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 – PRODUCTS

2.1 TRENCH/BACKFILL MATERIALS

- A. Trenching and Excavation Backfill: Select fill materials as specified in Section 01 57 13.
- B. Concrete Slurry: Select Flow Fill as specified in Section 01 10 00
- C. Concrete Pavement: Select concrete paving materials as specified in Section 01 60 00
- D. Asphalt Pavement: Select asphaltic paving materials as specified in Section 01 60 00

2.2 CONDUIT SYSTEM

- A. Non-Metallic Conduit:
 - 1. PVC plastic pipe, ASTM D1785, Schedule 40, Type PVC 1120.
 - 2. Tone Tape, Arnco DL WP12LC Tone Tape, or equivalent.
- B. Conduit Joint Couplings:
 - 1. PVC non-metallic fittings must be installed with solvent applied couplings.
 - 2. An approved transition coupling shall be used to connect metal to plastic (PVC) conduits.
 - 3. Couplings may be threaded and / or glued to provide watertight seal at conduit junctions.
- C. Electrical Metallic Tubing (EMT): Electro-galvanized steel tubing 3/4" and larger diameter per project requirements.
 - 1. Conduit joint couplings and connectors: steel double set screw indenter fittings.
 - 2. Metal bushings for 3/4" and 1" conduit.
 - 3. Insulated metallic bushings for 1-1/4" and larger conduit.
 - 4. Insulated metallic bushings with grounding lugs as required.
 - 5. Conduit sweeps: minimum 10 times the conduit inside diameter.
 - 6. Include required conduit straps, and hangers, heavy-duty malleable iron or steel.

Perforated pipe strap or wire hangers are not permitted.

- D. Inside Pull-Boxes: Reference Section 27 05 28 for inside pull-boxes for conduit entering building.
- E. Outside Pull-Box: Minimum 14 gauge galvanized steel with weatherproof locking cover and hardware for surface mounting as required for project. Dimensions as required for project.
- F. Test mandrel shall be ¼" smaller than inside conduit diameter and not less than 12 inches long.
- G. Pull-rope: 1/4" Nylon pull rope.
- H. Core Drill Seals for Outside Building Walls: Link-Seal waterproof assembly or equal. Manufactured by PSI/Thunderline/Link-Seal, 6525 Goforth Street, Houston, TX 77021.
- I. Conduit Caulking Compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.
- J. Underground Plastic Line marker: Manufacturer's standard permanent, continuous-printed polyethylene film tape with metallic core, intended for direct burial service; not less than 3" wide x 4 mils thick. Provide orange tape with black printing reading, "CAUTION TELEPHONE/DATA CABLE BELOW," or similar.
- K. Ground Wire: Bare Copper # 6
- L. Tracer Box: NEMA-3 4" x 4" weatherproof box
- M. Spacers for 4" Conduit: Carlon S289NJN Intermediate Spacer and S288NJN Base Spacer
- N. Precast Concrete Vault:
 - 1. General: Provide precast concrete communications vault as detailed on the Drawings and as required for installation of new duct-bank systems and connection to existing duct-bank systems at locations shown on the Drawings. Provide 4'-0" x 8'-0" x 6'-0" deep precast.
 - 2. Design: Vaults shall be steel reinforced and the complete vault assembly shall be designed for H-20-44 bridge loading. Submittals shall clearly indicate all dimensions and reinforcing steel.
 - 3. Concrete: Vaults shall be constructed using concrete with a 4500 psi 28 day strength. Concrete mix shall be designed in accordance with ASTM standards.
 - 4. Reinforcing Steel: Steel shall be intermediate or hard grade billet steel conforming to ASTM A15, deformed in accordance with ASTM A305.
 - 5. Vaults: Vault and pull box covers for all non-traffic areas shall be made of ductile iron cover, covers in parking and traffic areas shall be cast iron and rated for heavy vehicular traffic. Mount covers in a 30" Type "B" or "WRM" frame. The frame and neck shall be doweled into the vault to prevent movement away from the opening. Voice and Data communications vaults and pull box covers shall be marked "TELECOMMUNICATIONS".
 - 6. Conduit Entry: Plastic conduits shall include a bell end inside the vault or pull box, mounted flush and grouted to seal openings. Precast fiber type terminators shall be provided for each duct-bank entry.
 - 7. Grounding: A #4/0 bare copper ground wire shall penetrate the side wall in the bottom section of each vault and pull box and extend 48" inside and outside of the vault pull box.
 - 8. Accessories: Knockouts, cable racks, sumps, steps, joint seals and other accessories shown on the Drawings or required for a complete installation shall be provided.
- O. Duct Plug 4": General Machine Products (GMP) 6668R16

- P. End Bell 4": Carlon E297N
- Q. Squeegee is moistened pea-sized gravel and sand mixture.
- R. Multi-cell Fabric Mesh Duct:
 - 1. All fabric mesh duct shall be installed per manufacturer's requirements.
 - 2. Only manufacturer's fittings, transition adapters, terminators, accessories and installation kits shall be used.
 - 3. All fabric mesh duct shall be populated with a measured pull tape.
 - 4. Manufacturer: MaxCell.

2.3 CABLE ROUTING HARDWARE

- A. Cable Rack with Support Hardware as Required (or comparable):
 - 1. 18 Hole: Condux 08380200, Chance C203-1126
 - 2. Other Sizes as Required: Condux, Chance
- B. Cable Rack Steps/Hooks:
 - 1. 4": Condux 08380600, Chance C203-1131
 - 2. Other Sizes as Required: Condux, Chance
- C. "S" Rack Supports: Condux, Chance
- D. Step Lock Wedge: Panduit CHW-C20

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which the new exterior telecommunications pathways are to be installed. Provide notification, in writing, of conditions detrimental to proper completion of the work.
- B. Verify field measurements and pathway routing conditions are as shown on drawings. Provide notification, in writing, of conditions deviating from drawings.
- C. Beginning of telecommunications pathway installation indicates Contractor acceptance of existing conditions.

3.2 EXCAVATING, TRENCHING AND BACKFILLING:

- A. General: The work hereunder includes whatever excavating and backfilling is necessary to install the voice and data communications work. Coordinate the voice and data communications work with other work in the same area, including excavating and backfilling, dewatering, floor protection provisions, other temporary facilities, other underground services (existing and new), landscape development, paving, structural foundations, and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and backfilling.
- B. Standards: Except as otherwise indicated, comply with the applicable provisions of Division 2 for voice and data communications work excavating and backfilling. Refer instances of uncertain applicability to the Architect/ Engineer for resolution before proceeding with the Work.
- C. Coordinate excavating, trenching and backfilling with Landscaping, Civil, Mechanical, Plumbing and Electrical drawings. Voice and Data Communications duct-banks shall be independent of any other systems.
- D. Refer to Civil contract documents for information regarding required depths, slope and grade and additional information regarding trenches. Where these documents and the civil documents differ, bring any such differences to the attention of the engineer prior to construction. The bottom of the trench shall be accurately excavated to provide firm, uniform bearing for the

bottom of the raceways and duct-banks. Where mud or unstable soil is encountered in bottom of trench, it shall be removed to firm bearing and the trench shall be backfilled with bedding sand to proper grade and tamped to provide uniform firm support.

- E. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the conduit on undisturbed soil or 2" of sand fill at every point along its entire length. In general, grading for voice and data communications duct-banks and conduits shall be from building to vault, and from a high point between vaults to each vault.
- F. Exercise care not to excavate below required depth, leaving a flat bed of undisturbed earth, firm and secure, before laying conduit. In the event rock is encountered, excavate 6" below required depth and backfill to required depth with bedding sand, and compact to minimum 95% compaction.
- G. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or other acceptable method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted and removed from the site and properly disposed of.
- H. The Contractor shall be fully responsible for the safety of persons, materials and equipment in or near trenches or other excavations and provide all required sloping, shoring, railings and other protective provisions. The Contractor shall provide a trench shoring plan and design which is sealed by a registered professional engineer. Refer to Divisions 1 and 2 for additional requirements.
- I. If any unknown and/or uncharted utilities are encountered during excavation, promptly notify Architect/ Engineer and wait for his instructions before proceeding.
- J. If such unknown utilities are encountered and work is continued without contacting the Architect/ Engineer for instructions, and damage is caused to said utilities, the Contractor shall repair at his own expense, such damage to the satisfaction of the owner or utility company concerned.
- K. Trenches shall not be backfilled until all required tests have been made by the Contractor and approved by the Architect/Engineer and any local authorities having jurisdiction.
- L. Backfill shall be cement stabilized sand up to 6" above the top of conduit or duct-bank as required by code. Backfill up to grade shall be in maximum 6" lifts with minimum 95% compaction of lifts. Refer to Division 2 or elsewhere in Contract Documents for additional trenching and backfill requirements.
- M. Opening and Re-closing Pavement, Landscape Areas and Lawns: Where excavation requires the opening of existing walks, street, drives, other existing pavement or lawns, such surfaces shall be cut as required to install new conduit and to make new connections to existing conduits. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the area shall be patched or replaced, using materials to match those cut out or removed. Patches shall thoroughly bond with the original surfaces, shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas. All removed work shall be replaced by craftsman who regularly installs the types of work being replaced.
- N. Excavation in Vicinity of Trees: All trees including low hanging limbs within the immediate area of construction shall be adequately protected to a height of at least 5' to prevent damage from the construction operations and/or equipment. All excavation within the outermost limb radius of all trees shall be accomplished with extreme care. All roots located within this outermost limb

radius shall be brought to the attention of the Architect before they are cut or damaged in any way. The Architect will give immediate instructions for the disposition of same. All stumps and roots encountered in the excavation, which are not within the outermost limb radius of existing trees, shall be cut back to a distance of not less than 18" from the outside of any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots have been cut out of the excavation, clean compacted dry bank sand shall be backfilled and tamped.

- O. Perform all trenching and backfill for new underground conduit system placement as shown on the project drawings.
- P. Perform pavement marking as required as specified in Section 02 58 00.
- Q. All utilities to be located by contractor and exposed, if necessary, prior to construction.

3.3 CONDUIT SYSTEM PLACEMENT

- A. Place new conduit system including maintenance holes as shown on the project drawings.
- B. Twelve inch (12") clearance from all utilities to be maintained. If not possible, conduit to be encased in concrete slurry (flow fill) where proper distance cannot be obtained.
- C. Cross telecommunications conduit ducts below gas piping.
- D. All conduits shall be thoroughly cleaned before laying or using.
- E. During construction the ends of the conduits shall be plugged to prevent water washing mud into the conduits, vaults, or buildings. Particular care shall be taken to keep the conduits clean of concrete, dirt or any other substance during the course of construction.
- F. New and reopened trenches under asphalt roadways and parking lots must have concrete cap or be encased in concrete as required.
- H. Support multiple conduits on preformed nonmetallic separators to provide not less than 1" spacing between exterior surfaces of conduit (Type 5). Spacing between separators shall be close enough to prevent sagging of conduits or breaking of couplings and watertight seals.
- I. Squeegee is to be placed in the trench for 20' on each side of the vaults (Type 4).
- K. Conduits shall be securely anchored in place with nylon tie-downs to prevent movement during the placement of concrete slurry (flow fill), squeegee, and other backfill materials. Wire tie-downs are prohibited.
- L. Seal all conduit junctions and fittings watertight prior to pour of concrete slurry (flow fill). Conduit couplings shall be made in accordance with the manufacturer's recommendation for the particular type of conduit and coupling selected and as approved.
- M. Unless otherwise noted on drawings, a minimum two foot (24") depth of cover is required above the top of all conduits.
- N. Provide communication drain box in conduit six feet (6') from building outside wall penetrations as shown in project drawings. Conduit inside drain box shall be perforated to allow water and gas to escape.
- O. Transition to PVC coated GRC conduit five feet (5') from building outside wall penetrations.
- P. For all offsets and sweep bends, provide fiberglass or PVC coated GRC.
- Q. All conduit bends are to be minimum 3' radius or larger as noted on drawings.
- R. Bury underground plastic line marker one foot (12") above the telecommunications conduit.
- S. Cast into concrete a #6 bare copper ground wire directly above the telecommunications conduit

- and extend 4" into each vault space. Extend 6" of tracer wire into tracer box on outside wall of building directly above conduit entry point.
- T. Provide plastic conduit bell ends at each PVC conduit termination and for all conduit entering vaults.
 - U. Do not bore under concrete sidewalks, remove and replace sidewalks as necessary.
 - V. The new conduit shall extend through the wall into the building, tunnel, or crawl space a minimum of 4 inches.
 - W. Building, tunnel, and vault core drills must be sealed around conduits with approved waterproof plugging compound.
 - 1. Seal openings around conduits that pass through inside building wall core drills with UL listed foamed silicone elastomeric compound.
 - 2. Seal openings around conduits that pass through outside building walls with a complete Link-Seal assembly or equal for a waterproof seal. Slope conduit away from building.
 - 3. Seal openings around conduits that pass through vault walls with foundation foam on the interior of the core and silicone sealer on the inside and outside of the core for a waterproof seal.
 - X. Maintenance Holes (MH) shall be placed with the long dimension in line with the main conduit run. The conduit shall enter opposite ends of the MH on the short sides so that the MH shall not be used as a 90 degree bend in cable installations.
 - Y. The ends of the metallic conduit shall be reamed and bushed using:
 - 1. Insulated metallic bushings for 1-1/4" conduit and larger
 - 2. Insulated metallic bushings with grounding lugs for conduit entering TRs and ERs
 - Z.. After conduit duct installation has been completed and concrete has set, pull "D" test mandrel through all new conduit ducts to verify duct integrity and insure smooth interior surfaces free from burrs or obstructions that might damage cable sheaths.
 - AA. Following mandrel testing, draw cylindrical wire brush with stiff bristles through each conduit to clean the conduit and remove any concrete, dirt or other obstructions.
 - BB. Stub out conduits into ERs, TRs, and cabinets only enough to attach connector and bushings with grounding lugs except conduits shall rise a minimum of 6 inches above the finished floor.
 - CC. Install new pull rope in all new conduit and extending three feet into each building space.
 - DD. Plug ends of the new conduit with watertight rubber conduit plugs, conduit caulking compound, or conduit caps to ensure foreign matter does not enter the buildings.
 - EE. Refer to Owner prior to cutting or drilling any surface.
- 3.4 CABLE ROUTING HARDWARE
- A. Place new cable routing hardware in the tunnels and in crawl spaces beneath the building as required for the project and as shown on the drawings.
 - B. Perform installation of routing hardware as specified in Section 270526 including anchoring and supports, grounding and bonding, etc.
 - C. Place new ladder, pulling-in irons, cable racks, "S" rack supports, steps in new and existing vaults as required for backbone cable routing.
- 3.5 HORIZONTAL DIRECTIONAL DRILLING
- A. Owner shall be notified 48 hours in advance of starting horizontal directional drilling work. The directional drilling shall not begin until Owner is present at the job site and agrees that proper

preparations for the operation have been made.

- B. No work shall commence until Traffic Control and Construction Permits from Owner and/or the City are in place as applicable for the specific project.
- C. Site Preparation
 - 1. Prior to any alterations to work site, the entry and exit points shall be marked.
 - 2. No alterations to the work site beyond what is required for operations shall be made.
 - 3. All activities shall be confined to designated work areas.
- D. Drill Path Survey
 - 1. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings.
 - 2. If a magnetic guidance system is being used, the drill path will be surveyed for any surface geomagnetic variations or anomalies.
- E. All applicable environmental regulations shall be adhered to.
- F. Following drilling operations, the equipment will be de-mobilized and the worksite restored to its original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original site conditions.

3.6 SAFETY

- A. The contractor must comply with Owner regulations for asbestos, lead, and confined spaces.
- B. All applicable state, federal and local safety regulations shall be adhered to and all operations shall be conducted in a safe manner.
- C. Guard vault openings per NESC C-2-1997, 423.A:
 - 1. When covers of maintenance holes are removed, the opening shall be promptly protected with a barrier, temporary cover, or other suitable guard.
- D. Test for gas in vaults and unventilated vaults per NESC C2-1997, 423.B and C, including, but not limited to:
 - 1. The atmosphere shall be tested for combustible or flammable gases before entry.
 - 2. Where combustible or flammable gases are detected, the work area shall be ventilated and made safe before entry.
 - 3. Unless forced continuous ventilation is provided, a test shall also be made for oxygen deficiency.
 - 4. Provision shall be made for adequate continuous supply of air. Note: The term adequate includes evaluation of both the quantity and quality of the air.
 - 5. Employees shall not smoke in vaults.
 - 6. Where open flames must be used in vaults or vaults, extra precautions shall be taken to ensure adequate ventilation.

3.7 AS-BUILT DRAWINGS

- A. Mark the project drawings with notations reflecting any variations from the base specifications and drawings including as-built conduit routing.
- B. Comply with Construction Drawings As-Built Requirements attached to Section 01 78 00 Closeout Submittals.

END OF SECTION