CLOVIS UNIFIED SCHOOL DISTRICT

SPECIFICATIONS
FOR THE CONSTRUCTION OF

PORTABLE CLASSROOM IMPROVEMENTS

VIRGINIA R. BORIS ELEMENTARY SCHOOL
DSA File No. 10-27, DSA Appl. No. 02-120132

FUGMAN ELEMENTARY SCHOOL
DSA File No. 10-27, DSA Appl. No. 02-120131

CLOVIS ONLINE CHARTER
DSA File No. 10-27, DSA Appl. No. 02-120130

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CLOVIS UNIFIED SCHOOL DISTRICT

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VIRGINIA R. BORIS ELEMENTARY SCHOOL
FUGMAN ELEMENTARY SCHOOL
CLOVIS ONLINE CHARTER

PROJECT MANUAL

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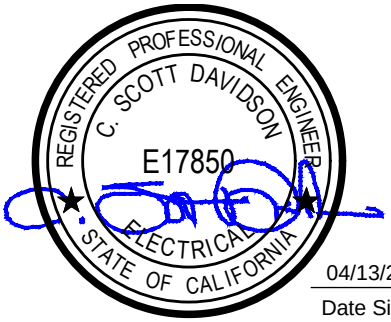

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SECTION 01 10 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all material, labor, equipment and services necessary to completely construct all site improvements, electrical improvements, landscape and irrigation improvements, accessories and other related items as required by the Contract Documents.

1.2 SCOPE OF WORK

A. The work to be done consists of, in general, removal of existing improvements to facilitate the installation of portable buildings at the campus, including site improvements, electrical and communication work, landscaping and irrigation modification and installation, and all other related items of work as shown on the construction plans and the specifications for the Clovis Unified School District Portable Additions. The work to be done is more specifically described below.

1. Site clearing, earthwork and preparation of the building pad for the portable buildings are the responsibility of the Site Contractor

2. Concrete paving and walks, including chain link fencing are the responsibility of the Site Contractor.

3. Site power distribution and final connections to the portable buildings are the responsibility of the Site Contractor.

4. Installation of new fire alarm components is the responsibility of the Site Contractor.

5. Installation of telecommunications systems is the responsibility of the Site Contractor.

6. Landscaping and irrigation modifications and improvements are the responsibility of the Site Contractor.

7. The portable buildings and ramps will be provided and installed by others. Contractor shall coordinate its schedule for completion of site work included in this contract with the work of other contractors working at the site and shall not unduly delay or interfere with the prosecution and completion of work by others.

8. The Site Contractor is responsible for coordination of all site work with the portable manufacturer. The portable manufacturer is Mobile Modular, 5700 Las Positas, Livermore, CA, 94550, contact Jenny Levas (925) 273-9786.

1.3 RELATED SECTIONS

A. All Division 00 Specification Sections

B. All Division 01 Specification Sections

1.4 Definitions

A. The words “OWNER” and “DISTRICT” are synonymous and are interchangeable when used throughout this Project Manual

1.5 SUBMITTALS

A. Submit in accordance with specification section SUBMITTAL PROCEDURES

1.6 CONTRACTOR’S DUTIES

A. Coordination and Interpretation of Plans and Specifications

1. The work covered by this Project shall be done in accordance with these specifications and with the City of Clovis and City of Fresno Standard Plans and Specifications; and Title 21 and Title 24 of the California Code of Regulations (CCR). Shall the referenced specifications conflict with one another, the more stringent requirement shall govern.

B. Permits and Licenses

1. The Contractor is responsible to pay all fees and to obtain said permits. An encroachment permit from the City of Clovis or City of Fresno is required if work is done within the public right-of-way.

C. Public Safety

1. The Contractor shall provide safe pedestrian access through or around the work site at all times for the duration of the project.

2. Temporary barricades, caution tape, snow fencing, or other means of preventing foot traffic within areas of work shall be installed by contractor.

D. Public Convenience

1. Some, or all, of this work may, of necessity, be required to be done while onsite facilities are being used for other authorized purposes. The Contractor is advised that the construction of this project may be during school hours and therefore, there may be students, faculty, visitors, and District personnel in the vicinity of the work.

E. Preservation of Property

1. Prior to excavating, the Contractor shall contact school officials to identify any known utility locations. The Contractor shall exercise extreme caution in excavating and compacting for this project in the area of suspected existing utilities and shall protect existing utilities from damage, in as much as their exact location or the exact number of utilities is uncertain.

F. Cooperation

1. The Contractor shall cooperate with all District personnel during their pursuit of normal work activities at the site, whether or not related to this work. There may be other contractors at the site conducting construction or maintenance operations under separate

contracts to the District. The Contractor shall cooperate with such other contractors to ensure that his or her activities do not delay or hinder their operations or the related activities of District Personnel. The District reserves the right to direct the order of the Contractor's work at the site as may be necessary to coordinate this work with other onsite operations and activities. The Contractor shall coordinate efforts with the District to ensure that campus irrigation practices and scheduling does not result in the saturation of soils in the work area

2. Full compensation for all costs involved in meeting and satisfying the details and requirements specified in this Section shall be included, as part of the contract lump sum bid for the entire project, and no additional payment will be made therefore.

G. Utility Locating

1. The Contractor shall notify Underground Service Alert (USA), by calling 811, and the District at least 48 hours prior to the scheduled commencement of construction operations to request identification and marking of known utilities in the area of the work.

2. Prior to excavating, the Contractor shall contact school officials to identify any known utility locations. The Contractor shall exercise extreme caution in excavating and compacting for this project in the area of suspected existing utilities and shall protect existing utilities from damage, inasmuch as their exact location or the exact number of utilities is uncertain. The Contractor shall exercise extreme caution in excavation and compaction operations in the area of existing utilities and shall protect them from damage. Marking and identification of utilities shall in no way relieve the Contractor of responsibility to protect and preserve existing utilities and responsibility to repair or replace those damaged as a result of his or her operations. No separate measurement or payment will be made for the protection and preservation of existing utilities or for the repair or replacement of existing utilities damaged by the Contractor, the cost thereof being considered as included in the contract lump sum price for the entire project.

H. Construction Staking

1. No construction staking will be provided to the Contractor. The Contractor shall retain, at his or her own expense, the services of State of California Licensed Land Surveyor or Civil Engineer to provide construction staking for all work involved in the project.

1.7 SCHEDULING

A. Beginning of Work

1. The Contractor shall begin onsite construction operations within ten (10) calendar days of the commencement date specified by the District in the Notice to Proceed. It is anticipated that this contract will be awarded by June 8, 2022, and a Notice to Proceed will be issued for June 20, 2022.

B. Progress Schedule

1. At least seven (7) calendar days prior to the commencement date, the Contractor shall submit a proposed progress schedule. The schedule shall indicate the dates proposed for beginning and completion of each part of the work. The schedule will be reviewed by the Engineer for practicability with respect to overall completion time and with respect to potential effects of the work on campus access and parking during construction. No onsite construction operations shall begin prior to the date of the Engineer's approval of the Contractor's proposed progress schedule.

2. The District has a separate contract with Mobile Modular for the installation of the portable buildings at the sites. Contractor shall complete all site improvements required for the installation of the portables no later than July 25, 2022, including any necessary testing and inspections, so that the portables can be installed by Mobile Modular. Contractor shall coordinate with Mobile Modular regarding site access, scheduling, and any other items necessary for the installation of the portables.

3. The Contractor shall diligently prosecute the remainder of the work to completion no later than fifty (50) calendar days total after the commencement date specified by the District in the Notice to Proceed.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

All work under Divisions 26, 27, and 28 is subject to the General, Supplementary, Special Conditions and other Division 1 Specification Sections preceding this section. The Contractor will be responsible for and governed by all requirements. Drawings indicate the general arrangement of the electrical layout and work included. The Contractor will follow these drawings to lay out and check the drawings of other trades to verify locations and spaces in which work will be installed.

1.2 SUMMARY OF WORK

A. This portion of the work includes furnishing of all labor and materials necessary for a complete wiring system to outlets and all equipment shown on the Drawings or covered by this section of the Specifications. In general, the work includes the following:

1. Utility services and facilities as detailed on the Plans, including the defrayal of the utility installation charges.
2. Power service and distribution system as shown, complete with switchboards, panelboards, feeders and motor control centers.
3. Complete system of branch circuit wiring and equipment including all wiring devices and plates on all outlets.
4. A new lighting fixture system complete with lighting controls, as shown on Plans, including factory commissioning and acceptance testing.
5. Telephone, public address, security, data and fire alarm systems, including conductors, cable, and equipment, for complete working systems. Each system shall be terminated, tested, calibrated, and programmed by a factory authorized installer. The same installer shall terminate and test any peripheral equipment required for the operation of the system.
6. Raceways, wiring, fused disconnect switches, etc., for equipment covered by other sections of these Specifications.
7. All hangers, anchors, sleeves, chases and supports for fixtures, electrical equipment and materials including earthquake bracing.
8. All excavating, backfill, concrete pads and bases as required for electrical work.
9. All disconnection and removal of existing electrical facilities not to be reused or noted to be demolished.
10. Include payment of all required insurances, electrical permits, fees and taxes unless specifically shown "BY OTHERS".

B. The electrical drawings are diagrammatic and do not necessarily show all raceway, wiring, number or types of fittings, offsets, bends or exact locations of items required by the electrical systems. Items not shown or indicated which are clearly necessary for proper operation, payment or installation of systems shown shall be provided at no-increase in contract price.

C. The exact routing of systems and location of devices and equipment shall be governed by coordination with other trades, structural and architectural conditions. The Architect or Electrical Engineer reserves the right, at no increase in contract price, to make reasonable changes in location of electrical equipment or wiring systems; so as to coordinate with other systems, group them into orderly relationships, or to increase their utility. Contractor shall verify requirements in this regard prior to roughing in.

D. Install electrical work in cooperation with other trades and make proper provisions to avoid interferences and coordinate with structural and architectural features, in a manner approved by the Architect or Electrical Engineer. All changes caused by neglect to make such provisions shall be at Contractor's expense. Provide offsets and special fittings, as required to facilitate installation of the work.

E. When a particular product or type of product is specified with a manufacturer's designation, the latest published specifications, installation, and construction information of the manufacturer shall constitute the minimum acceptable standard. Any substitutions shall be made in accordance with the SUBSTITUTIONS sections of the Specifications.

1.3 RULES AND REGULATIONS

A. All work and materials shall be in full accordance with the latest rules and regulations of the following:

1. California Electrical Code (CEC), 2019 Edition
2. California Energy Commission, Title 24, 2019 Standards
3. California Fire Code, 2019 Editions
4. National Fire Alarm and Signaling Code NFPA 72, 2019 Edition
5. California Building, Mechanical and Plumbing Codes, 2019 Editions
6. California Code of Regulations

    a. Title 8, Safety Orders
    b. Title 19, Fire and Panic Safety Standard
    c. Title 24, Part 1, Administrative Regulations

7. Occupational Health and Safety Act (OSHA)
8. California State Fire Marshal Rules

B. Where two or more codes conflict, the most restrictive shall apply.

C. Nothing in these Plans and Specifications is to be construed to permit work not conforming to these codes.

D. Before the Final Certificate of Payment will be issued, the Contractor shall deliver to the Owner all Certificates, Permits, Record Drawings and Instructions/Parts Manuals.

1.4 TESTS AND STANDARDS

A. The tests, standards, or recommended procedures of the following agencies shall relate to all parts of these Specifications and shall be considered a minimum:

1. American National Standards Institute (ANSI).
2. Underwriters Laboratories, Inc. (UL).
3. National Electric Manufacturers Association (NEMA).
4. Electrical Testing Laboratories (ETL).
5. National Fire Protection Association (NFPA).
6. Insulated Power Cable Engineers Association (IPCEA).
7. Institute of Electrical and Electronic Engineers (IEEE).
8. Illumination Engineering Society (IES).

1.5 EXAMINATION OF DOCUMENTS AND SITE

A. Before submitting a proposal, each bidder shall carefully examine the electrical, mechanical, architectural, and structural drawings and specifications. He shall also visit the site and fully inform himself as to all existing conditions and limitations applying to the work. If, after such examination and study, it appears that any change from the drawings and specifications should be allowed, the bidder shall so state in writing together with any change in cost involved.

B. By the act of submitting a proposal, each bidder shall be deemed to have made such examinations of the drawings and specifications and premises, and it will be assumed that he is therefore familiar with the entire scope of the project and has based his proposal upon the work described in the Drawings and Specifications and upon all existing conditions and limitations applying to his work.

1.6 IMPLEMENTATION

A. Workmanship: The work shall be performed by competent workmen, skilled in the particular phase of the work entailed. The work shall be first class throughout, neat, accurate and in full accordance with the intent of these Specifications and the satisfaction of the Architect or Electrical Engineer.

B. Safety: All standard safety procedures as set forth by OSHA, CCR, and California Division of Industrial Safety shall be strictly adhered to.

C. Coordination: The Contractor shall familiarize himself with the work of other crafts so as to be able to provide electrical service of correct size and voltage and other requirements to any equipment to be installed.

D. Scheduling: The installations shall be coordinated as to location and time, and interference causing delays and non-acceptable construction shall be avoided. Order equipment in a timely manner to prevent any delays in the construction schedule and he shall bear any penalty by vendors to meet schedules.

E. Collaboration: Prior to commencing construction the Electrical Contractor shall arrange a conference with the general and sub-contractors as well as equipment suppliers and shall verify types, sizes, locations, requirements, controls, and diagrams of all equipment furnished by them.

F. Materials: All equipment and materials shall be new, UL (Underwriters Laboratories) approved, and of the best quality. When specific trade names are used in connection with materials they are mentioned as standards but, this implies no right upon the part of the Contractor to substitute other materials or methods without prior approval.

G. Excavation: The Contractor shall provide all excavating and backfill required for the proper installation of electrical work, whether or not shown on the Drawings or as specified. This shall be done per the EXCAVATION portion of the Specifications.

H. Cutting and Repairing: The Electrical Contractor shall do all cutting necessary for the proper installation of his work, repair any damage done by himself or his workmen, and coordinate his work with that of others. Do no cutting or patching without approval of the Architect or Electrical Engineer. Round holes through concrete slabs or walls shall be core drilled with a diamond drill, rectangular openings shall be cut with a diamond saw. In no case shall any concrete beam or column be cut.

I. Sleeves and Openings: Electrical Contractor shall be responsible for all sleeves and openings through walls and floors required by electrical work. All openings around conduits in sleeves shall be sealed with a material of equal fire rating as the surface penetrated. Openings not utilized shall be temporarily sealed in a similar manner. All required sleeves shall be furnished to and coordinated with the General Contractor.

J. Cleaning and Painting: All exposed work shall be thoroughly cleaned upon completion of work. All panelboards and equipment not located in electrical or mechanical rooms or closets shall be field painted per painting specifications, color as selected by Architect. Panelboard enclosures, fixtures, and equipment, where finish has been marred in shipment or installation, shall be completely refinished. Minor finish damage shall be rectified as indicated by the Architect or Electrical Engineer. Contractor shall remove all waste and rubbish resulting from his work from the site.

K. Earthquake Restraint: All electrical equipment shall have a means to prohibit excessive motion during an earthquake. Equipment that vibrates during normal operation shall have isolators with mechanical stops. All transformers are considered to vibrate during operation. All electrical equipment and connections shall be designed to resist lateral seismic forces equal to value shown on Drawings of equipment weight with allowable working code capacity increased by 1/3 or 1.5 times the same value for the weight yield capacity. Connections shall be the same except the 1/3 increase will not be allowed.

L. Mechanical Equipment and Other Special Equipment:

1. Prior to commencing construction, the Contractor shall arrange a conference with the Mechanical and Plumbing Contractors, and the Equipment Suppliers, to verify type, sizes, locations, requirements, controls and diagrams of all equipment furnished by them. In writing, he shall inform the Electrical Engineer that all phases of coordination of this equipment have been covered. If any unusual conditions or problems arise, they are to be enumerated them at this time.
2. The Contractor shall furnish all electrical line voltage wiring, fused disconnects and conduits, unless otherwise shown.
3. The Contractor shall be responsible for electrical hook-up and connection to all electrical equipment furnished by all Contractors of this Project. This includes all mechanical equipment, plumbing equipment, and special equipment furnished by other contractors.

M. Portable and Detachable Parts: The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of his work. These parts shall be itemized and delivered to the Owner at Project Closeout.

1.7 QUALITY CONTROL

A. Supervision: The Contractor shall personally, or through a competent representative, constantly supervise the work from beginning to completion and final acceptance. He shall cooperate fully with the inspection authorities in the provision of information and access to the work. He shall, to the best of his ability, maintain the same job foreman throughout the life of the project unless a replacement is requested or authorized by the Architect or Electrical Engineer.

B. Inspection and Tests: The Contractor shall furnish all labor and test equipment required to fully test and adjust the equipment installed under this specification and demonstrate its proper operation.

1. Arrange for all tests and inspections and provide minimum 48 hours' notice to the Architect or Electrical Engineer.
2. A test must demonstrate that each piece of equipment, outlet, fixture, device, and appurtenance is in sound operating condition and in proper cooperative relation to associated equipment.
3. All tests shall be conducted under supervision of the Architect or Electrical Engineer, and any defects of any nature which are apparent as a result of such test shall be made correct to the satisfaction of the Architect or Electrical Engineer before final acceptance is made.
4. No equipment shall be tested, or operated for any other purpose, such as checking motor rotation, until it has been fully checked in accordance with the manufacturer's instructions.

C. Warranty: The Contractor agrees to replace or repair, to the satisfaction of the Owner, any part of the installation which may fail due to defective material and/or workmanship or failure to follow Drawings and Specifications, for a period of one year after final acceptance. Any damage to other work resulting from such failure or the correction thereof shall be remedied at the Contractor's expense. The Contractor shall, further, secure from the manufacturers of special equipment, such as signal systems, their respective guarantees and deliver same to Owner. Guarantees between Contractor and his suppliers shall not affect warranties between Contractor and Owner.

1.8 SUBMITTAL

A. Make submittal for all material to be used on the project, whether as specified or substitutions, within thirty five (35) days after award of Contract by the Owner, in accordance with Section 01-300, SUBMITTAL, and the following:

1. All submittal shall be neat and bound in a suitable folder or binder.
2. Identify each item by manufacturer, brand, trade, name, number, size, rating, and whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
3. Identify each submittal item by reference to specifications section paragraph in which item is specified, or Drawings and Detail Number.
4. All submittal shall be submitted in coherent groups, e.g. all light fixtures at one time. No partial, or incomplete submittal will be accepted.
5. Organize submittal in same sequence as they appear in specification sections, articles or paragraphs.

B. Product Data: Submit eight copies, in groups, as follows:

1. Boxes, pullboxes, conduits, and raceway types required, including fittings
2. Electric Wire, cable and connectors
3. Circuit breakers, Panelboards, Transformers, and disconnects.
4. Lighting fixtures
5. Wiring Devices
6. Special System Equipment

C. Shop Drawings: Shop drawings shall show physical arrangement, wiring diagram, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, weight, power sources, circuit numbers, and shall be compatible with the Contract Drawings and Specifications.

D. Show wiring as actually installed, connected, and identified for this specific project. Include identification of cables and cable conductors.

E. Shop and instruction drawings shall cover the equipment or device to be installed and not merely the general class of such equipment or device.

1.9 SUBSTITUTIONS

A. The Specifications or Drawings are in no way to be construed as being proprietary toward one product. Those products, or types of products, listed are intended to set the standard for quality, design, and installation procedure. However, no right is implied upon the part of the Contractor to substitute other materials, products or systems without the written approval of the Architect or Engineer.

B. All requests for substitution shall be made in accordance with the SUBSTITUTIONS section of the Specifications.

C. All requests for substitutions shall be in writing, received at least 14 days prior to bid date, and shall indicate all information required thereon including differences from the specified item. The request for substitution shall be accompanied by cuts, product literature, performance data, specifications, drawings, samples or other means as may be required for proper evaluation by the Architect or Electrical Engineer.

D. All proposed substitutions shall be standard product of the firm under current manufacture and be a catalog item at time of bid.

E. Acceptance of substitution shall not relieve the Contractor from responsibility for complying with requirements of the Contract Documents. The Contractor shall be responsible for changes in other parts of the work occasioned by his substitutions and shall bear their expense.

F. Representative samples may be required for determination of equality. It is understood that the samples may be subjected to destructive testing and will not be returned.

1.10 GUARANTEE

This Contractor agrees to replace or repair to the satisfaction of the Owner, any part of the installation that may fail due to defective material and/or workmanship, or failure to follow Plans and Specifications for one year after final acceptance. He shall further obtain from the manufacturers of special equipment (i.e., control systems) their respective guarantees and service manuals and deliver to Owner.

1.11 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

The Engineer's decision will be final on interpretation of the Drawings and Specifications. Whenever "AS MAY BE DIRECTED", "SUITABLE", "APPROVED EQUAL", “AS REQUIRED”, or other words of similar intent and meaning are used which infer that judgment is to be exercised, it is understood that it is the judgment of the Engineer being referred to.

PART 2 – PRODUCTS

2.1 RACEWAYS:

A. Except where specifically shown otherwise in this section, the Contractor shall furnish and install a complete steel, rigid thread galvanized rigid steel conduit system for all wiring, including control and signal wiring.

B. Galvanized Rigid Steel (GRS)

1. All conduits shall be rigid threaded hot dipped galvanized type.
2. Joints are to be sealed with conductive pipe compound T&B "Kopr-Shield" before making up.
3. Conduits installed below grade shall be wrapped with 3M "Scotchrap #51" corrosion protection tape using half-laps for double thickness. Conduit surfaces are to be clean and dry before wrapping.

C. Steel Electrical Metal Tubing (EMT)

1. EMT may be used within the hollow dry spaces of buildings, minimum 96” above the finished floor. Trade sizes 4" and smaller may be used within hollow dry spaces of the building.
2. EMT conduit shall be Allied True Color E-Z Pull, or equal, with a colored finish specific to the following systems:

a. Natural: 0-150V-to-Ground Power & Lighting
b. Yellow: > 150V-to-Ground Power and Lighting
c. Blue: Copper Data & Communications
d. Orange: Fiber Optic Cable
e. Red: Fire Alarm

3. All raceway fittings, locknuts, couplings, elbows, etc., shall be hot dipped galvanized steel finish with plastic throats or bushings. Cast-type fittings shall not be used.

D. Non-Metallic Polyvinylchloride Conduit (PVC):

1. Rigid nonmetallic PVC, UL labeled and fittings approved for the purpose may be used for electrical systems 0-600V-to-ground under the following conditions:

a. All conduits in earth under buildings or protected by permanent paving may be Schedule 40 PVC. Any conduits running through planters or unprotected are to be encased in 3" of concrete. All raceways above grade are to be steel.
b. Risers shal be blue color, factory PVC coated T&B "Ocal" steel ells. Bends less than 45 degrees and offsets may be field bent.

2. All nonmetallic runs shall have a bond wire for the interconnecting of all conducting portions per Article 250 of the California Electric Code.
3. PVC shall never be used above grade.

E. Liquid-Tight Flexible Metal Conduit (LFMC):

LMFC may be used in lengths not greater than 36" at motors and other machinery to prevent the transmission of vibration. LFMC shall be supported at both ends.

F. Surface raceways and fastenings are to be two-piece steel type, complete with all fittings of the same manufacturer and factory finished in gray. Surface plug-in strips shall be two circuit type with NEMA grounded receptacles every 12" with wiring space provided.

G. The minimum size conduit for lighting, power, and signal wiring shall be 3/4" trade size.

H. Conduits installed underground shall have a minimum coverage of 24" below a finished grade. Provide a magnetically traceable warning tape at 12" below grade. Electrical systems rated greater than 150V to Ground shall have a 3" concrete envelope.

2.2 CONDUCTORS:

A. All conductors shall arrive to the project in their original, unbroken packages plainly marked as follows:

1. Packaging shall indicated underwriter’s labels, size, conductor material, insulation of wire, names of the manufacturer and the trade name of the wire.
2. Wire or cable shall have factory markings every 24". Markings shall show its maximum allowable voltage, wire size and insulation.

B. All conductors shall be a minimum of 98% conductivity, soft drawn copper, minimum #12 AWG unless shown otherwise. All conductors shall be stranded. Insulation shall be 600 Volt, type "THWN.”

C. Control circuits for mechanical equipment in locations subject to abnormal temperatures on or under furnaces and heaters shall be Type "RHH" 600 Volt insulation conductors.

D. All branch circuits, fixture wiring joints, splices and taps for conductors #10 and smaller to be made with "Scotchlok" connectors.

E. Two-bolt type solderless connectors or T&B "ColorKeyed" compression lugs shall be used on #8 and larger conductors.

2.3 WIRING DEVICES:

A. Furnish and install wiring devices and plates as shown on the Drawings and described in these Specifications. Where more than one wiring device is mounted in the same location, such devices shall be mounted in a multi-gang plate. Wiring devices shall be specification grade or better.

B. Wiring devices shall be of the color selected by the Architect.

C. Convenience outlets to consist of a specification grade duplex receptacle mounted in an outlet box in the wall, flush with the finished plaster or surface. Outlet rating to be 20 AMPS, 125 Volts, 3-wire, back and side wired.

D. All outlets shown outdoors or in damp locations shall be GFI type, installed in a weatherproof box and cover equipped with rubber gaskets. Surface outlets shall be weatherproof type FS boxes with hubs as required and equipped with rubber gaskets and weatherproof covers.

E. Local switches shall be quiet toggle type, totally enclosed, 20 AMPS, 277 Volts AC rated.

F. Device plates shall be provided for all devices with the number of gangs and openings necessary. They shall be satin brushed 302 stainless steel, unless specified otherwise.

G. Switch plates for all outlets not in sight of a switch shall be labeled with filled etched letters showing locations of the outlet controlled.

H. Pilot lights shall be the type with an indicating neon lamp in a handle.

2.4 OUTLET BOXES:

A. Outlet boxes for concealed work shall be one piece pressed steel knock-out type with zinc or cadmium coating. Boxes shall not be smaller than 4" square nominal size unless otherwise indicated. Provide extension rings, extenders, plaster rings and covers necessary for flush finish. No back-to-back or through-boxes shall be used.

B. Bar hangers shall be used to support outlet boxes in stud or furred partitions and ceilings. Attachment screws, devices, etc., shall be of the proper type to secure boxes to metal studs. Use expansion shields in concrete and masonry. Where used for lighting fixtures, outlet boxes shall be equipped with fixture studs.

C. Provide approved knock-out seals on all unused open knock-out holes.

D. Outlet boxes installed in concrete slabs shall be two-piece concrete boxes, not less than 4" nominal size with a minimum depth of 2 ½".

E. Surface boxes of cast metal threaded hub-type with suitable gasketed covers shall be used for exposed conduit runs less than 5' above finished floor, or where waterproof boxes are required.

2.5 PULL BOXES AND WIREWAYS:

A. Pull and junction boxes shall be installed as shown to ease the pulling of wire and to comply with CEC requirements.

B. Wireways shall be constructed in accordance with UL 870 for wireways, auxiliary gutters and associated fittings. Every component, including lengths, connectors, and fittings, shall be UL listed.

2.6 TERMINAL CABINETS AND CLOSETS:

A. Cabinets and fronts shall be in accordance with NEMA Standard Publication No. PB 1-1971 and UL Standard No. 67. Fronts shall include doors and have flush brushed stainless steel, cylinder tumbler-type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All locks shall be keyed like the panelboard locks. Fronts are to be adjustable indicating trim clamps that shall be completely concealed when the doors are closed.

B. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with the door in the locked position. A frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge full finish steel with rust inhibiting primer and baked enamel finish.

C. Install finish grade 3/4" plywood board, primed and painted light gray on both sides and the edges, at the interior rear surface of telephone and signal cabinets.

D. Provide solderless box lugs, terminal blocks with a white marking strip for conductors sized #16 and larger. Punch-down terminals shall be used for No. 18 and smaller and shall be used for all public address, intercom and other electrical terminations.

2.7 FLOOR BOXES AND UNDERFLOOR DUCTS:

A. Provide fully adjustable Type 1, Class 1 watertight floor boxes complete with pedestal and wiring device where shown on Plans.

B. Furnish and install a complete duct system as shown on Plans. The system shall consist of separate ducts: No. 2 duct for electrical power service; No. 4 duct for telephone; No. 4 duct for data. Ducts shall have 2" inserts on 24" centers. Furnish and install the necessary junction boxes, couplings, supports, adapters, etc., to form a complete assembly made watertight with sealing compound.

C. Ducts and junction boxes shall be manufactured from 14 gauge steel. They shall be UL listed and finished with a corrosion resistant coating. The junction boxes must be furnished with the proper depth to accommodate floor finish. Junction box cover plates to have an upward adjustment of 3/8". Cover plates must be leveled flush with the finished cement floor before and after the concrete has hardened.

D. Furnish and install, where shown, telephone, data and power service fittings. All service fittings shall be furnished with receptacles, adapters and no spin locking nipples or supports.

E. Fittings for floor boxes or ducts shall be brushed aluminum finish.

F. Provide carpet flanges of proper size in carpeted or tiled areas.

2.8 CONCRETE PADS, PULL HOLES AND MANHOLES:

A. At the Contractor's option, he shall provide cast-in-place or precast structures.

B. Where applicable, concrete structures shall be submitted to the serving utility for their approval before installation.

C. Cast-in-place concrete shall be per the concrete section of the Specifications.

D. Provide 8" concrete pads under all exterior switchboards, transformers, etc.

2.9 NOISE CONTROL:

A. Outlet boxes at opposite sides of partitions shall not be placed back-to-back or through-boxes employed except where specifically permitted on the Drawings by note to reduce transmission of noise between occupied spaces.

B. Contactors, starters, and similar noise-producing devices shall not be placed on walls that are common to occupied spaces unless specifically called for on the Drawings. Where such devices must be mounted on walls common to occupied spaces, they shall be shock mounted or isolated in such a manner to effectively prevent the transmission of their inherent noise to the occupied space.

C. Contactors, starters, drivers, and like equipment found noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced at Engineer's request.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL:

A. The layout and installation of electrical work shall be coordinated with the overall construction schedule to prevent delay in completion of the project. Checking these Drawings before organizing the electrical work schedule or installing material and equipment shall be obligatory.

B. Dimensions and information regarding accurate locations of equipment and structural limitations and finish shall be verified with other sections.

C. The Drawings do not show all the offsets, bends, special fittings, junction boxes, or pull boxes necessary to meet job conditions and the CEC. They shall be provided as required.

D. Electrical equipment, outlets, junction and pull boxes shall be installed in accessible locations avoiding obstructions, preserving headroom and keeping openings and passageways clear.

E. Minor adjustments in the locations of equipment shall be made where necessary, providing such adjustments do not adversely affect function of the equipment. Major adjustments for the location of equipment shall be approved by the Architect and detailed on the Record Drawings.

F. Structural Fittings: Furnish and install the necessary sleeved, inserts, hangers, anchor bolts and related structural items. Install at the proper time.

G. Openings have been shown on the Architectural and Structural Drawings. Should any additional openings or holes be required for the work of this section, the cost shall be the obligation of this section.

H. Contractors shall inspect and account for existing conditions affecting his work.

I. Sleeves for electrical conduits passing through walls or slabs shall be placed under the work of this section before concrete is poured. Where conduits pass through suspended floor slabs, sleeves shall be standard weight galvanized steel pipe extending 2" above the finished floor level.

J. Sleeves at other locations shall be either light weight galvanized steel pipe or galvanized sheet steel. Clearance between conduits and sleeves shall not be less than ½".

K. Sleeves through outside walls and below grade shall be caulked tight with oakum and the ends sealed with an approved semi-plastic coal tar base compound or shall be of the stuffing box type. Other sleeves shall be packed with glass wood ends sealed with Duxseal and covered with chrome plated escutcheon plates.

L. Conduits entering through floor slabs at grade level will not require sleeves and shall be placed with tops of couplings flush at floor level.

M. Sleeves for electrical conduit passing outside walls below grade shall be the through-wall and floor seal type.

3.2 INSTALLATION OF CONDUITS AND RACEWAYS:

A. Raceways for electrical or signal systems run in earth that are not protected by permanent paving shall be encased in concrete with the encasement extending under the building. Branch circuit and signal system conduits installed underground between outlets, terminals, and panels within the building shall be liquid and gas tight.

B. Conduits shall be concealed unless otherwise shown. All conduit runs exposed to view, except those in attic spaces, shall be installed parallel or at right angles to structural members, walls, or lines of the building.

C. All conduit runs shall be mechanically and electrically continuous from outlet to outlet. Conduit size or type shall not be changed between outlets.

D. No conduits shall be run on the roof unless specifically shown on the roof. They shall be full weight rigid steel on PVC sleepers. Install roof jacks at penetrations.

E. Conduit stubs installed for future extensions shall be rigid steel for at least 5' of a conduit run. The conduit ends shall be terminated with couplings and pipe plugs. The closed end shall be double wrapped with Scotchrap #50 for the last 12". The concrete envelope shall leave 3" of the wrapped conduit exposed for future connection.

F. Conduit for equipment connected permanently to the floor shall be installed with a 6" rigid conduit nipple to a flush coupling to ensure a watertight connection at the floor.

G. All conduits shall be sloping to drain and shall be sealed with JM Clipper "Duxseal" on the high end.

H. All conduit bends shall be carefully made so that the conduit is not flattened, kinked or otherwise compromised. The inner radius of any conduit bend shall be not less than eight times the inside diameter. Where conduits are run exposed in groups, bends of all conduits shall have a common center. Use of standard elbows will not be allowed at these locations.

I. Each run of a conduit shall be finished before concrete, plaster, etc., is installed to ensure against obstruction or omissions. After installation, the ends of all conduits shall be plugged with metal pennies. All conduit systems shall be completed and thoroughly cleaned and dried inside before installation of any

conductors.

J. Conduits shall enter at right angles and be connected to all outlet boxes, pull boxes, and cabinets with locknuts and plastic throated grounding bushings, providing a continuous grounding system in accordance with CEC Article 250.

K. Use Erikson couplings where a union is necessary. Running threads will not be permitted.

L. Pull 1/8" stranded nylon pull ropes with 18" coiled at each end in all empty conduits with identification tags indicating source and destination.

M. Furnish and install seal-offs in all conduit runs through areas of different temperature.

N. All concealed conduits shall be installed in as direct a line as possible between outlets. No more than four (4) quarter bends or their equivalent will be allowed between outlets. Feeder conduits shall follow arrangement shown on Plans unless a change is authorized. In general, branch circuit conduits shall follow the arrangement as shown insofar as structural conditions permit.

O. All exposed runs shall parallel buildings, walls, or partitions, and shall be supported on Kindorf Hangers to meet Title 24 Part 6, California Code of Regulations.

P. All telephone, data, and other signal conduits shall be installed with long radius sweeps. No factory ells will be permitted.

Q. Chrome escutcheon plates are to be used on all conduit penetrating walls, floors or ceilings.

R. Expansion joints shall be provided at building structural expansions or as required due to length of run or difference in temperatures.

S. All fittings exposed or in damp areas shall have sealing glands and proper gaskets. Fittings in hazardous areas shall be of the type approved for the particular hazard.

T. Provide two 1" conduit stubs out of all panels and terminal cabinets to above a hung ceiling or as otherwise shown.

U. Roof Penetrations:

1. Where raceways penetrate roofing or any similar structural area, provide iron roof jacks sized to fit tightly to a raceway for a weather-tight seal with the flange extending a minimum of 9" under roofing on all sides. Completely seal the opening between the inside diameters of the roof flashing and the outside diameters of the penetrating raceways. Coordinate all work with the roofing section of Specifications.

V. Fire Penetration Seals:

1. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration before, during or after a fire. The fire rating of the penetration seal shall be at least that of which it is installed so that the original fire rating is maintained as required by CEC Article 300.21.

2. Where applicable, provide OZ Type CFSF/1 and CAFSF/1 fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs and similar structures. Apply an approved firestopping system, including wall wrap, partitions, caps and other accessories as required. All manufacturers' instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.3 CONDUCTORS AND CONNECTIONS:

A. General Requirements:

1. All branch circuit and fixture wiring joints, splices and taps for conductors #10 and smaller shall be made with UL approved connectors listed for 600 Volts. Connector bodies shall consist of a cone shape rotating expandable coil spring inserts insulated with phenolic or plastic shell.

3. Do not install wire in conduits until all work of any nature that may cause injury (including pouring of concrete) is completed. Use care in pulling in wires to prevent damage to wire or insulation. Do not use blocks, tackle or other mechanical means to pull #8 AWG or smaller conductors.

4. Splices are not permitted except in outlet boxes, pull boxes, junction boxes, panelboard gutters and auxiliary gutters. No splices shall be made in underground boxes.

5. Use only wire pulling compounds listed by the UL as a lubricant for pulling conductors through raceways. The use of cleaning agents that have deleterious effect on conductor coverings are not permitted.

6. Unless otherwise shown on Plans or specified elsewhere, leave at least 12" of free conductors at each connected outlet (outlets connected to equipment or device) and 9" of free conductors and coil neatly in outlet box for future connection.

B. Terminations:

1. Circuit and signal terminations to single screw or push on terminals shall be done with insulated “Sta-Kons” or approved equal terminals.

2. Bolt type solderless connectors shall be torqued with a torque wrench according to the manufacturer's recommendations and then retightened after 24-48 hours before taping. Owners' inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.

C. Feeders and Branch Circuits:

1. Connectors and lugs for terminating stranded conductors sized #8 and larger shall be machine crimp compression type.

2. All splices shall be taped with Scotch "Super 88" vinyl electrical tape, and "Scotch Fill" tape putty where necessary for a smooth joint. For other than normal temperatures or conditions, Scotch #27 or #2520 shall be used.

3. No splices shall be made below grade in a manhole or pull holes without the Engineer's written approval. When approved, these shall be encapsulated with 3M potting kits per 3M Specifications.

4. Wires in panels, cabinets, pullboxes and wiring gutters shall be squared, labeled, and neatly grouped with Ty-raps and fanned out to the terminals.

5. Support all conductors in hand holes/manholes and label with plastic rope. Tag all conductors with plastic waterproof tags.

3.4 WIRING DEVICES:

A. Wiring devices shall be securely fastened to the outlet box. Where the outlet box covers are back from the finished walls, the device shall be built-out with washers so that it is rigidly held in place to the box. Provide metal extenders in flammable construction per CEC.

B. All device screw slots shall be left in a vertical orientation.

3.5 OUTLET BOXES:

A. Boxes shall be securely fastened in position to the ceiling or walls with screws or bolts. Nails are not acceptable. The Contractor shall set and align all equipment, level, bolt down, or otherwise secure in place. No back-to-back or through-boxes shall be used.

B. Boxes shall be accurately located and set square and true with exposed edges of a box or plaster ring flush with finished surface of walls or ceiling. All unused boxes shall be equipped with blank covers that shall match existing covers.

C. Boxes shall have no unused openings.

D. Boxes shall be cleaned of all direct plaster, etc., before conductors are installed. Rust spots shall be scraped to bare metal and painted with Rust-Oleum "Cold Galvanizing Compound".

E. Suspended fixture outlets shall be equipped with 3/8" fixture mounting stud bolted to wood backing or metal studs to safely support fixture weight.

F. Make any change in outlet location necessary to all job conditions and rearrange fixtures and equipment as directed.

G. Study all Plans as to relation of spaces surrounding outlets so that this work may be installed at the proper time with others. Fixtures and equipment shall be symmetrically located. Conflicts and discrepancies shall be referred to the Architect immediately and prior to box installation.

3.6 JUNCTION AND PULL BOXES AND WIREWAYS:

A. Boxes shall be installed square and plumb. An engraved nameplate shall be installed indicating the function of each box on the exterior in unfinished areas and on the interior in finished areas. Permanent markers are not acceptable.

B. Pullboxes and wireways shall be concealed or installed flush in finished areas. They shall be surface mounted in machine rooms or unfinished areas.

3.7 TERMINAL CABINETS AND CLOSETS:

A. Install, level and identify per schedule.

3.8 FLOOR BOXES AND PEDESTALS:

A. Floor boxes are to be installed level and plumb. Fill with paper prior to pouring concrete. Re-level after concrete has set, then raise to accommodate the floor finish.

B. The installation of pedestals shall be coordinated with cabinet work.

3.9 GROUNDING:

A. The conduit system supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded by means of approved ground clamp, in accordance with the electrical safety orders of the Department of Industrial Relations of the State of California.

B. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded around the boxes with a #6B&S gauge, rubber covered, double braided wire with ground clamps.

C. Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations.

D. A separate grounding conductor shall be run in all receptacle circuits.

3.10 IDENTIFICATION

A. Conductors:

1. All power and low voltage systems conductors and cabling shall be identified in accordance with the following schedule:

   a. 120/208 Volts, 3-phase, 4-wire Wye: Red-Black-Blue, Neutral White
   b. 120/240 Volts, 3-phase, 4-wire Delta: Black-Blue for single-phase, Orange for 3-phase stinger, Neutral White
   c. 480/277 Volts, 3-phase, 4-wire Wye: Yellow-Brown-Purple-, Neutral Grey
   d. Bond or grounding conductor (GWG): Green
   e. Special system conductors shall be color coded and labeled

2. Brady Labels shall be used to identify terminals and destination of feeders, branch circuits, signal and control circuits, etc., at all terminations and junction boxes and shall be coordinated with the nameplates in all boxes and equipment.

3. All terminals in the switchboards, panels, relays, switches, devices, starter terminals, etc., shall have Brady Labels for identification to identify both ends of all wiring. Wires #8 and smaller to be terminated on terminal strips squared-type 9080K with white marking strip and screw lugs for wire size.

B. Nameplates: The Contractor shall furnish and install 1" x 3" x 3/32" thick laminated black Nylon nameplates with a white core, unless specifically shown as red with a white core, engraved to produce white letters on black background for all items of electrical equipment including 2-pole and 3-pole circuit breakers, panelboards, starters, relays, time switches and disconnect switches. The plates shall screwed in place with stainless steel screws. Adhesive backed plates are not acceptable.

C. Panels: Panels having single-pole circuit breakers shall be provided with typed schedules mounted in welded metal holders behind plastic.

D. Devices: All devices shall have their branch circuit identified on the back side of device plate with a permanent type black marker, i.e., CKT A-21.

3.11 CONCRETE PADS, PULL HOLES AND MANHOLES:

A. Contractor shall provide a minimum of 3'-6" of sand or base material suitable to receive the manhole. The base material shall be compacted, graded level, and at proper elevation to receive the manhole in relation to the conduit grade or ground cover requirements as designated in the Plans.

3.12 SUPPORTS AND ANCHORS:

A. Provide inserts, anchors, supports, rods, brackets and miscellaneous items to adequately support and secure the electrical systems and equipment.

B. Secure hangers, brackets, conduit straps, supports and electrical equipment to surfaces by means of toggle bolts on hollow masonry. Utilize expansion shields and machine screws or standard preset inserts on concrete or solid masonry. Utilize machine screws or bolts on metal surfaces. Utilize wood screws on wood construction. Wood, fiber plugs, or concrete nails are not acceptable.

C. Power or velocity driven inserts may not be used for any anchorage unless specifically approved by the Engineer and where the use does not affect the finished appearance of work. Under no circumstance shall these be used in pre-stressed slabs, beams, purlins, or precast members in tension.

D. Seismic Requirements: Provide vertical and lateral supporting equipment to resist the application of seismic forces per California Code of Regulations, Title 24 Chapter 23.

END OF SECTION

SECTION 26 20 00 - LOW VOLTAGE ELECTRICAL TRANSMISSION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 - Specification sections, apply to work of this section.

B. Section 26 05 00 – Common Work Results for Electrical section and other Division 26 sections apply to work specified in this section.

1.2 SCOPE:

A. Work included: Furnishing and installation of a complete electrical service, distribution, and grounding system. Conditions of this section apply to all other 26-series sections included.

B. Related Work: Refer to other sections, particularly those listed below, so as to properly coordinate work specified herein with that specified elsewhere to produce a finished, workmanlike, fully functioning installation.

C. All other Electrical Sections: Division 26

1.3 QUALITY ASSURANCE:

See Section 26 05 00.

1.4 SUBMITTAL:

A. Product Data: Submit manufacturer's data on service entrance equipment, switchboards, motor control centers and/or individual starters, transformers, panelboards, disconnect switches and grounding components.

B. Trip Curves: When requested, submit trip timing curves for all circuit interrupting devices.

C. Nameplate Schedule: Submit nameplate schedule for approval.

1.5 COMPONENT COORDINATION:

In order to maintain close control and coordinate the various components of the distribution systems, the number of manufacturers shall be kept to a minimum. Equipment manufacturer shall be General Electric or Square D. It shall be the manufacturer's responsibility though the Electrical Contractor to coordinate all components of the system in order to ensure systems that will provide maximum protection of equipment and reliable safe operation.

1.6 NAMEPLATES:

Laminated phenolic plastic, color coded black for 120/208 volt equipment, with white letters. Provide for

identification of each transformer, panelboard and motor control center, secure to face with two (2) chrome plated screws each. A schedule of nameplates shall be included with the shop drawings for approval.

1.7 FEEDER CONNECTIONS:

Provide cast, saddle type bolted lugs or hydraulically set compression lugs for all bus connections. Manufacturer shall be Thomas and Betts, Burndy, O.Z. or approved equal. Lugs in which the set of screw embeds directly into feeder conductor shall not be used.

1.8 MISCELLANEOUS:

A. Equipment Bases: Provide appropriately sized concrete housekeeping bases for all floor-mounted equipment.

B. Hoisting Lifting Lugs: Provide on all heavy equipment as required to ensure safe hoisting.

C. Space for Future Protective Device: Provide as indicated on drawings; shall be completely equipped for the future addition of a circuit breaker or fused switch, including all connections.

PART 2 – PRODUCTS

2.1 PANELBOARDS:

A. Panelboards shall be Bolt-down Circuit Breaker type, with voltage, phase, and breakers as specified in panelboard schedules. Panelboards shall be installed flush or surface or specified, at locations as indicated on plans. Panelboards shall be installed in code gauge rust proof steel cabinets with flush door having flush locks all keyed alike and with trim cut square and true.

1. Panelboards: Square D, type NQ, NQOB, and NF; General Electric A-Series and Spectra Series; or approved equal.

B. All panelboards and breakers shall meet the requirements of the indicated available symmetrical short circuit current or have a minimum bus bracing to meet figure shown.

C. All interiors shall be completely factory assembled. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machining, drilling or tapping.

D. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. A nameplate shall be provided listing panel type and ratings.

E. Unless otherwise noted, full size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug or each outgoing feeder requiring a neutral connection. A ground bus will be included in all panels.

F. Boxes shall be at least 20 inches wide made from galvanized steel. Provided minimum gutter space in accordance with California Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

G. Door hinges shall be concealed. All locks shall be flush, stainless steel, cylinder tumbler type locks with catches and spring loaded door pulls, keyed alike and directory frame and card having a transparent cover shall be furnished with each door.

H. All exterior and interior steel surfaces of the trim shall be properly cleaned, primed with a rust inhibiting phosphatized coating and finish with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim clamps shall not be accessible when the panel door is closed and locked.

I. All main bus bars shall be cooper or tin plated aluminum sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above an ambient of 40 degrees C maximum.

J. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multipole breakers. (Trip indication shall be clearly shown by the breaker handle taking position between ON and OFF when the breaker is tripped). Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" and carry the SWD marking. UL Class A (5 milliampere sensitivity) ground fault circuit protection shall be provided on 120V ac branch circuits as specified on the plans or panel board schedule. This protection shall be an integral part of the branch circuit breaker which also provided overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional slide pole circuit breaker. Connections to the bus shall be bolt on.

2.4 DISCONNECTS:

A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.

B. Disconnect switches shall be suitable for area where they are installed, i.e., weatherproof, and shall be rated heavy duty. Use only 600 volt class with proper number of poles. Switches shall be fused unless indicated on plans. Fuses shall be of type specified on plans.

C. When a disconnect switch is not clearly visible from the control location, provide an operating handle which is lockable in the open position.

2.5 GROUNDING:

A. Clamps, bonds, etc. suitable and as necessary to provide continuous ground system.

B. Ground Rods: "Copperweld" 3/4" diameter 8' long.

C. All grounding conductors shall be copper, sizes not less than that required under CEC Table 250.122.

D. All grounding electrode conductors shall be copper, sizes not less than that required under CEC Table 260.66.

2.6 SWITCHBOARDS:

A. Manufacturer's: Subject to compliance with requirements, provide switchboards of one of the following:

General Electric Company
Square D Company

B. General: Except as otherwise indicated, provide switchboards of types, sizes, characteristics, and ratings indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for complete installation. Service entrance switchboards shall comply with serving utility requirements.

C. AC Dead-Front Distribution Switchboards: Provide factory assembled, dead-front, metal enclosed, self-supporting secondary power switchboards, of types, sizes and electrical ratings and characteristics indicated; consisting of panel (vertical) units, and containing circuit breakers of quantities, ratings and types indicated. Provide copper or tin plated aluminum main bus and connections to switching devices of sufficient capacity to limit rated continuous operating temperature rise to 54 degrees F, and 90 degrees F for circuit breaker branches; with main bus and tap connections silver-surfaced and tightly bolted for maximum conductivity. Brace bus for short circuit stresses up to maximum interrupting capacity. Prime and paint switchboard with manufacturer's finish and color. Construct units for outdoor, NEMA Type 3R.

D. Enclosures: Construct dead-front switchboards, suitable for floor mounting, with front cable/wire and conduit accessibility as indicated. Provide welded steel channel framework, hinge wireway front covers to permit ready access to branch circuit breaker load slide terminals. Coat enclosures with manufacturer's standard corrosive resistant finish.

E. Bussing: Provide switchboard with sufficient cross-sectional area to fulfill U.L. Standard 891 pertaining to temperature rise.

2.6 MOTOR STARTERS:

A. Manual motor starters to be quick-make, quick break, with overload protection. General Electric cr 101 for 120/240 volt 1 hp or less.

B. Magnetic motor starters shall be across the line unless indicated with control power transformer (120 volt coil) and with overload relay protection. Combination type shall have integral fused switch or circuit breaker as indicated.

2.7 TRANSFORMERS:

A. Transformers, Dry Type: Distribution transformers shall be constructed and tested in accordance with ASA and NEMA Standards, and shall be wound with copper conductors. Performance of transformers shall be equal to or exceed ASA and NEMA published criteria.

B. Transformers shall be self-cooled type with Class H, NEMA, Group 111 insulation and a temperature rise of 150°C under continuous full load conditions with an ambient of 400°C.

C. Transformers supplying voltage to wave altering devices (computers, electronic ballasts, etc.) shall be K3 rated minimum, or as noted otherwise on plans.

D. Transformers shall be equipped with four 2 1/2% taps (2 taps above and 2 taps below normal voltage). Windings shall be of the fire-resistant type, designed for natural convection cooling through normal air circulation.

E. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, erection and short circuit stresses.

F. Enclosure cover plates shall be Code gauge sheet steel, captive bolted to the enclosure framework. Enclosure shall have suitable ventilating openings with rodent-proof screens. Enclosure shall be provided with lifting lugs and jacking plates as required.

G. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, except cores and core mounting frames, shall be cleaned, rust-proofed and given a heavy coating of an inert primer.

H. Transformers used indoors shall be “low noise.” They shall be provided with vibration dampers. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

I. Transformers shall be manufactured by General Electric, Square D, or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION OF SWITCHGEAR AND SWITCHBOARDS:

A. Install switchgear and switchboards as indicated, in accordance with manufacturer's written instruction, and with recognized industry practices to ensure that switchboards comply with requirements of NEMA and CEC standards, and applicable portions of NECA's "Standard of Installation".

B. Prior to energization of circuitry, check all accessible connections to manufacturer's torque specifications. Subsequent to wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.

3.2 INSTALLATION OF PANELBOARDS:

A. Provide mounting brackets, busbar drilling, and filler pieces for unused spaces.

B. Branch circuits shall be connected as shown in line diagrams and/or panelboard schedules, with wires neatly tie wrapped in panel.

C. All distribution panelboards shall have all sub feeders and main breakers marked with 1" x 3" plastic name tags secured with two self tapping screws.

D. All panelboards shall be provided with a 2" x 3-1/2" plastic name tag on the front of the panel door or on the trim, indicating panel designation and distribution panel and circuit feeding above panel, secured with two self tapping screws.

E. Branch circuit panelboards shall have a plastic covered circuit directory card on the inside of each door with all circuit destinations neatly typed.

F. Contractor shall check and tighten all factory made wire or lug connections. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.

G. Install four (4) spare 3/4" conduits from all panelboards to accessible ceiling space.

3.3 INSTALLATION OF DISCONNECTS:

Install disconnects for all equipment and motors of the size required and as recommended by manufacturer.

3.4 INSTALLATION OF GROUNDING:

A. Scope: Provide grounding system complying with the codes and ordinances specified. Grounding system shall provide continuity through the entire electrical system.

1. Panelboard ground buses.
2. PVC conduit or other raceways.
3. All motors.
4. All lighting fixtures.
5. Grounding terminals of all receptacles.
6. Miscellaneous grounds required by code.

B. Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations.

C. Good, electrically continuous, metal to metal contacts shall be made wherever possible at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded round the boxes with a 6 BS gauge, rubber covered, double braided wire with ground clamps.

D. A separate grounding conductor shall be run in all conduit runs from distribution, lighting, and power, etc. panelboards, motor control outlets, etc., back to their respective service or distribution panelboards.

E. Flexible Conduit Grounding: Provide a separate grounding conductor in all flexible conduit runs to include watertight flexible conduit with integral grounding straps. Install ground conductors inside conduit with ungrounded conductors. Extend from nearest panel to device being connected.

F. Receptacle Circuits: Provide a separate grounding conductor in all receptacle circuit conduit runs, back to serving panelboard.

3.5 INSTALLATION OF MOTOR STARTERS:

A. In finished areas, mount motor protection switches flush and install suitable cover plates.

B. Install heaters correlated with full load current of motors provided.

C. Set overload devices to suit motor provided.

3.6 INSTALLATION OF TRANSFORMERS

A. Transformer core frame shall be installed level on shock absorbing pads within the enclosure.

B. Mounting bolts on floor-mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.

C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits.

D. Voltage Check:

1. The Contractor shall set the taps on all transformers (which are a part of this contract) as necessary to provide satisfactory operating voltages with all present loads energized. A check shall be made in the presence of the District Inspector at a panel fed from each transformer and which is the farthest from the transformer. Voltages at the transformers ranging from 118 to 122 volts inclusive, for 120-volt systems and proportionately equivalent for higher voltage systems, are acceptable.
2. The Contractor shall provide all instruments and accessories required to perform the checks. Volt meters shall be accurate within 1% and shall have scales permitting the voltage readings to be made on the upper half of the scale.

3.7 CONNECTIONS TO NEW MANHOLES

Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

3.8 CONNECTIONS TO EXISTING MANHOLES

For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

END OF SECTION

SECTION 27 00 00 - TELECOMMUNICATION SYSTEMS

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. This specification section provides general conditions for all division 27 specifications. All contractors working with in the division 27 specification shall adhere to this specification and these related specifications:

Section 270528 - Communication Infrastructure Systems
Section 271000 - Structured Cabling System
Section 272010 - Uninterruptable Power Supply
Section 274040 - Assistive Listening System
Section 274200 - Classroom Amplification System
Section 274220 - Multi-Purpose Sound System
Section 275313 - Analog Synchronous Clocks
Section 277000 - Intercom-Clock-PA System
Section 278000 - Video Surveillance System

1.2 STATEMENT OF WORK

A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Structured Cabling and Communications Systems.

B. Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in this Document. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the contractor feels that the system described is incomplete, they must address this in writing to the Owner/Owner's Representative before providing a bid.

C. All questions concerning non-specified product and services will be address to the Owner's Representative before Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.

D. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of devices, typical installation details, and mounting details will be provided as an attachment to this document. The successful vendor shall meet or exceed all requirements for the systems described in this document.

E. Contractors DO NOT remove Owner network equipment without written approval from the Owner.

1.3 EXISTING CABLING AND SYSTEMS EQUIPMENT

A. Demolition of cabling systems per CEC 2013

1. Remove all cabling defined for demolition per CEC 640.2, 640.6.C, 645.2, 645.5.F, 725.2, 725.25, 770.2, 770.25, 770.154.A, 800.2, 800.25, 800.154.A, 820.2, 820.25, 820.154, 830.2, 830.25,

2. The owner shall be given “first right of refusal” for all decommissioned equipment and removed cable.
3. The owner may wish to keep, recycle or destroy these items. If the items are refused by the owner the contractor may keep, recycle or destroy these items.
4. Owner will establish a location for all materials it wishes to keep, recycle or destroy.

B. Contractor SHALL NOT demo any existing analog telephone cables or outlets, except where complete reconstruction occurs. The existing telephone cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any telephone cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.

C. Contractor SHALL NOT demo any existing intercom cables or outlets, except where complete reconstruction occurs. The existing intercom cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any intercom cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.

D. Contractor SHALL NOT demo any existing coaxial CATV cables or outlets, except where complete reconstruction occurs. The cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.

E. Contractor SHALL NOT demo any existing CCTV cables, outlets, or cameras except where complete reconstruction occurs. The existing cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed. Coordinate with Owner for the removal of any cameras in the way of the scope of work. Owner will remove existing cameras.

F. Contractor to coordinate with the Owner for the scheduled removal of any existing network equipment, such as, but not limited to, wireless access points, access point mounting brackets, network switches, and network routers. All equipment is to removed by Owner and NOT the contractor. Owner will remove and re-install any network equipment unless specifically coordinated with Contractor.

1.4 REGULATORY REFERENCES

A. Contractor will comply will all Federal, State, Local Codes/Regulations and Industries Standards.

1. Federal:

- NFPA 70 - National Electric Code(NEC)
- FCC - Part 15, Part 68
- ADA – Americans with Disabilities Act

2. State of California:

- CCR Part 2 - California Building Code.
- CCR Part 3 - California Electrical Code
- California Electric Code(CEC) 2019
- Occupational Safety and Health Act (OSHA).
- Title 24, Building Standards, State of California.
- Title 19, California Code of Regulations.
- Title 8, Electrical Safety, State of California

3. ANSI Standards:

- ANSI C2-2001 National Electrical Safety Code.
- ANSI C80.3 Specification for Zinc-coated Electrical Metallic Tubing.
- ANSI/UL 797 Electrical Metallic Tubing.
- ANSI/ICEA S-83-596-2001 - Fiber Optic Premises Distribution Cable Technical Requirements.

4. Industry Standards:

- Telecommunications Industry Associations/Electronics Industry Association (TIA/EIA)

TIA/EIA-568.0-D	Commercial Building Telecommunications Cabling Standard
TIA/EIA-568-1.D	General Requirements
TIA/EIA-568-C.2	Balanced Twisted Pair Cabling Components Standard
TIA/EIA-568-3-D	Optical Fiber Cabling Components Standard
TIA/EIA-569-A	Commercial Building Standard for Telecom Pathways and Spaces
TIA/EIA-606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
TIA/EIA-607	Commercial Building Grounding/Bonding Requirements
TIA/EIA-758	Customer-Owned Outside Plant Telecommunications Cabling Standard
TIA/EIA-758-1	Addendum No. 1 to TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard

- National Electrical Manufacturer's Association (NEMA)
- Institute of Electrical and Electronic Engineers (IEEE)

  802.3 (Ethernet)
  802.3ab (Gigabit Ethernet over 4-pair Category 5e, 6 & 6A or higher)
  802.3Z (Gigabit Ethernet over optical fiber)
  802.11ac (Wireless LAN Specfications)

- Underwriters Laboratories Inc. (UL)
- International Organization for Standardization/International Electromagnetic Commission (ISO/IEC) ISO 11801 Generic Cabling for Customer Premises
- Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM 13th Edition or latest).
- ASCII - American Standard Code for information Interchange
- ASTM - American Society for Testing and Materials

B. If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

C. This document does not replace any code, either partially or wholly. The contractor must be aware of and comply with all local codes that may impact this project.

1.5 SAFETY/CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

A. Safety and Indemnity

1. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work.
2. The Contractor shall ensure that all personnel working in or anywhere on the site shall be provided a hard hat, safety shoes, a face shield or safety goggles, etc. for their protection.
3. No act, service, drawing review or construction observance by the owner's representative or any other party employed by the campus is intended to include review or approval of adequacy of the Contractor's safety measures, in, on or near the construction site.

B. Contractor Qualifications

1. Each low voltage contractor/sub-contractor shall submit their qualifications to the district prior to award of contracts.
2. Contractor shall have been in business for no less than five (5) years and have installed of a minimum of 3 projects of similar size and scope.
3. A Manufacturer Certified Installer contractor, currently certified in the Owner's standard solutions, shall complete the System installation. The contractor shall have completed standards based product and installation training. A copy of the Contractor's Manufacturer Certified Installer certificate shall be submitted with their submittal.
4. Sub-Contractor Qualifications

    - All Contractors shall submit a list of at least three (3) projects of similar dollar volume completed within the past 24 months for reference purposes.
    - The Contractor shall compile detailed information relating to similar work completed, including corporate references sufficient to enable the Owner to evaluate and agree to the Contractors' responsibility, experience and capacity to perform the work.
    - Each Contractor to perform telecommunications work on this project shall possess a C-10 or C-7 (formerly C-61) Limited Specialty License for Telecommunications and must be certified for the installation, termination, splicing, and testing of copper cables, fiber optic cable, riser cable, and inside wiring. The appropriate contractor's license for underground construction and conduit installation is also required.
    - An on-site Contractor superintendent must be available at all times. Contact can be by person or telephone.

5. Contractors who do not meet the minimum specified requirements will not be accepted.

C. Quality Assurance

Contractors are required to comply with the following without exception:

1. The winning Contractor will assign this project to a competent Project Manager who has demonstrated their ability to supervise a telecommunications project of the same size and scope.

    - The contractor will make this person available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.
    - Project Manager will be required to be available for scheduled on site project meetings at no additional cost to the Owner.
    - Project Manager will be required to be available to meet on site with the Owner/Owner's representative with a minimum of 24 hours' notice for non- emergency issues, and a

minimum of 4 hours for emergency issues at no additional cost to the Owner.

2. All material and equipment to be installed on this project shall be ”new”. If the Owner/Owner’s Representative discovers that “used” material or equipment has been installed on this project the Contractor will be required to replace said materials and/or equipment with “new” products at no additional cost to the Owner.

   - “New” - Materials and products manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the manufacturer. Also these materials and equipment may not have been in use before installation on this project unless directed otherwise in the project documents.

3. Contractor must warranty all materials, equipment and labor for a minimum of one (1) year from the Owner’s acceptance of the work.

   - Warranty will provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including Labor, drive time, shipping, taxes, etc.).
   - Contractor is required to keep in stock replacement parts for all items covered in this specification and provide a competent service technician to be on site to repair/replace defective items no later than 24hours after receiving trouble call.
   - Warranty will cover normal Business hours, 8am – 5pm, Monday thru Friday. All calls received on a Friday or the day before a holiday will be held until the following regular business day.

4. Contractor must submit for full manufacturer extended warranty upon completion of the project. Warranty certificate to be sent directly to Owner.

1.6 SUBMITTAL DOCUMENTATION

A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule

B. The successful contractor shall provide three (3) copies of their submittal package.

C. The Submittal Package will include:

1. All documentation given will be in a Bond Cover or in a Three (3) Ring Binder.

2. A coversheet on the Contractor’s Company Letterhead including:

   - Contractor’s Name
   - Contractor’s License Number
   - The Project Name
   - The Specification Number and Description
   - The date documentation was submitted.

3. A spreadsheet with a full material list of products and equipment included in the Contractor’s bid price. Spreadsheet will provide:

   - Manufacture Name
   - Part Number

- Description
- Quantity to be installed for each part.

4. A legible copy of the Manufacturer's Catalog Cut sheet for each part included in the Contractor's bid.

    - The Catalog Cut sheets shall be placed in the same order as shown on the spreadsheet.

5. Copies of the Manufacturer's Certification for a minimum of the Project Forman and 50% of the installation crew.

6. Sample of Labeling Scheme. Contractor will provide a sample for each identifier to be used on this project. Labels are to be approved by Owner prior to printing.

D. LEED/CHIPS/HPSA (when applicable to project provide additional submittal information)

1. Recycled content, segregated by pre- and post-consumer percentages.

2. Rapidly renewable material content.

3. VOC content

4. Distances from site to follow material process locations.

    - Raw material harvest, collection or extraction
    - Product or component fabrication
    - Final material manufacture, if different than component fabrication

1.7 EQUIVALENT PRODUCTS

A. Pre-Approved Equals:

1. All pre-approved products shall be listed in the relevant specification section.

B. Contractors wishing to approve a system other than those specified in this document will be required to perform the following:

- Provide System specifications and cut sheets for all system components for the proposed new system(s).
- Provide an itemized comparison to each of the system functions as described in this specification. Include in that document how the proposed system compares to the specified system described in this document on a line by line basis, using one of the following three criteria: "exceeds"/"matches"/"unequal".

C. All other products than those specifically address in the bid document that the Contractor is seeking approvals for must be *received* by the Owner's Representative *no later than 5 business days before the bid date*. All Approved Equals will be published in addendum form prior to the bid date.

D. Failure to received written approval for product installed that deviates from the products called for in this specification and/or on the project drawings will result in the contractor having to replace the unapproved materials and equipment with the originally specified products at no additional cost to the Owner.

1.8 All proposed system documentation must be sent to the Owner's Representative via one of the following; mail, fax or email. The Contractor will include the project name, their contact information, and the specification section number that the proposed system is comparable to.

1.9 ACCEPTANCE AND WARRANTIES

A. Project Acceptance

1. The Owner and the Contractor shall accept the project as complete based on the following criteria:

- Before executing any performance testing, the Contractor shall present a test plan to the Project Engineer for their approval.
- The Contractor has completed all testing and delivered copies of all test results to the owner's representative.
- All test results have been examined and approved by the Contractor and the Project Engineer.
- Copies of all documentation required by this section have been delivered to the Project Engineer.
- All punch list items are completed to the satisfaction of the Inspector-of- Record.
- Manufacturer Warranty Certification Certificates are provided to the Owner.

2. Following completion and/or compliance with the requirements listed above, the Contractor shall issue a Notice of Completion confirming that the project is complete. A 45-day acceptance period shall begin immediately following the issuance of the Notice of Completion.

3. Minor failures shall be responded to at the Owner's discretion or within one business day.

B. Manufacturer Warranties

1. The installed 271000 structured wiring (as applicable for given cable media) system, including both inter-building and intra-building sub-systems, shall be warranted by a manufacturer for a 15-year period or greater. Lifetime warranty is the warranty period preferred by the Owner and will be given preference where applicable.

2. The warranty certified systems will be a complete system comprised of products from a single solution manufacturer, warranted to operate as a guaranteed system for the entire channel (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.). The Solution Manufacturer shall administer a follow on program through the Vendor to provide support and service to the purchaser, and a single extended warranty point of contact. In the event that the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.

3. The Contractor shall be responsible for correcting any problems and malfunctions that are warranty-related for the entire warranty period. In the event that a Contractor should not be in business at the time of an issue, the manufacturer shall be responsible for all corrections, if deemed the responsible party.

4. Copies of any extended material warranties shall be passed through to the Owner.

5. During the installation and up to the date of final acceptance, the Contractor shall protect all finished and unfinished work against damage and loss. In the event of such damage or loss, the Contractor shall replace or repair such work at no cost to the Owner or any other Trade Partnership

working on the project.

END OF SECTION

SECTION 27 05 28 - COMMUNICATIONS INFRASTRUCTURE SYSTEM

PART 1 – GENERAL

1.1 STATEMENT OF WORK

A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Underground Ducts and Raceway systems. All systems described herein shall be governed by the Division 16000 specifications, should these two documents be in conflict the more stringent shall prevail.

B. The locations of vaults and pull boxes on the drawings are approximate and reflect the best information available. The Contractor is responsible for locating all existing utilities within the areas to be excavated prior to excavation. Final location of all trenches, communications utility vaults, and pull boxes must be verified and signed off on by the Owner/Owner's Representative.

C. The contractor shall furnish and install all work necessary to make compete systems, whether or not such details are mentioned in these specifications or shown on the drawings, but which are necessary in order to complete working systems, excepting those portions that are specifically mentioned therein or plainly marked on the accompanying drawings as being installed or supplied by others.

1.2 CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

A. Safety and Indemnity

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 "1.5 A. Safety & Indemnity".

B. Contractor Qualifications

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 "1.5 B. Contractor Qualification".

C. Quality Assurance

1. Contractor shall comply with all requirements as specified in Section 270000 "1.5 Quality Assurance".

D. Warranty

1. Contractor shall comply with all requirements as specified in Section 270000 "1.8. Acceptance & Warranties".

1.3 SUBMITTAL DOCUMENTATION

A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270000 "1.6 Submittal Documentation".

1.4 EQUIVALENT PRODUCTS

A. All Products described and Part Numbers given in this Specification are those of Leviton, Berk-Tek, Superior Essex, and Cooper B-Line unless otherwise noted.

B. Pre-Approved Equals:

1. Utility Vault Company, Christy Concrete, BES
2. Hoffman, B-Line, Circle AW
3. CARLON, Allied Tubing, MaxCell
4. RANDL Inc , Thomas & Betts, Bridgeport, Appleton, Erico, Minerallac
5. Wiremold, Hubbell

C. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 270000 “1.7 Equivalent Products”.

PART 2 – PRODUCTS

2.1 PATHWAYS & FITTINGS

A. Communication Underground Boxes

1. Communication Pull Boxes

- Provide separate pre-cast concrete pull boxes, with lids labeled "communications" (for TV, telephone, data, security).
- Type equal to “Christy N16, N30, N40, N44” steel reinforced solid concrete box, concrete lid & 12” extension box shall be used. See project drawings for locations & additional requirements.
- Shall be constructed out of 3000 PSI steel reinforced concrete.
- Install on 6” gravel pad and provide drain. See project details for more info.
- Pull boxes in traffic areas and along roads shall be designed and installed for H20-44 loading.
- Pull boxes shall be located and provided with grade rings as necessary to ensure that water is drained from conduits.
- Pull boxes shall be installed to minimize surface drainage entry as follows:

    1. Pull boxes should not be located in paths or streets. If such location cannot be avoided, pull boxes should not be located in low spots or drainage channels.
    2. Pull boxes not located in paths or streets should be installed so that the top is approximately 2" above final grade.

- All pull boxes shall be installed with a mow strip minimum of 6”.
- Non-slip lids shall be provided for pull boxes in sidewalk areas. Use concrete or fiberglass-no metal lids in sidewalks.
- Quantity: Contractor will provide pull boxes and covers in the sizes and quantities as shown on the drawings.

2. Communication Vaults

- Provide separate pre-cast concrete vault, with lids labeled "communications" (for TV, telephone, data, intrusion alarm).

- Vaults shall be equipped with a cable racking on the long walls suitable to support large copper cables as called for on the design documents.
- Vaults shall include; Anchorage, Lifting Inserts and Racking Devices.
- All Vaults shall be equipped with traffic-rated lids with a locking mechanism. All lids shall have the identification marking of "Communications" permanently affixed to the cover.
- All pull boxes shall be installed with a mow strip minimum of 12".
- Quantity: Contractor will provide vaults and covers in the sizes and quantities as shown on the drawings.
- Standard Vault size 24"x36"x36" equal to Old Castle 2436-STD
- Large Vault size 36"x60"x36" equal to Old Castle 3660-STD

3. Communication Vault Accessories
UNDERGROUND CABLE RACK HOOKS Lite Duty Extension

- Formed from 3/16 inch steel
- Hot dipped galvanized per ASTM A123 / A153
- Smooth top surface to protect cables from damage
- Insulator 11A31 fits these hooks
- Part numbers Inwesco or equal

Catalog No.	Extension From
10A35	4
10A36	7-1/2
10A37	10
10A38	14
10A39	18

4. Heavy Duty Extension

- Formed from 10 ga. steel
- Hot dipped galvanized per ASTM A123 / A153
- Unique design locks hook into rack
- Part numbers Inwesco or equal

Catalog No.	Extension From Face of Rack (Inches)
10C38	14

5. J-Hook Cradle

- Curved design to cradle cable
- Available in fusion bonded epoxy coated steel
- Available in injection molded ABS plastic
- Steel used is 1/4 inch thick x 15/16 inch wide

- ABS plastic hooks are 1-3/8 inch wide
- ABS plastic hooks furnished with locking tab
- Part numbers Inwesco or equal

Catalog No.	Type	Diameter Of Curve (Inches)
10A60	Coated Steel	2-1/2
10B60	Plastic	2-1/2
10A61	Coated Steel	5
10B61	Plastic	5

6. Surface-Mounted Entrance Cabinets Type 1 & 12

- The Contractor shall provide a minimum of a NEMA 1 type enclosure that meets the UL 50, File No. E27567: Type 1 NEMA/EEMAC Type 1 CSA, File No. LL42184: Type 1 IEC 60529, IP30 standards for indoor applications.
- The Enclosure shall be constructed from 16 awg galvanized steel, with a drip shield top and seam free side, front and back.
- The Enclosure shall have a "slip-on" removable front cover held in place with steel screws.
- Enclose shall incorporate pre-punched knockouts for standard trade size conduits up to 1".
- The size of cabinets mounted on an outside wall to serve a smaller building shall be as indicated on the construction plans.
- Quantity: Contractor will provide boxes in the sizes and quantities as shown on the drawings.

7. Surface-Mounted Entrance Cabinets Type 3R and 4X

- The Contractor shall provide a minimum of a NEMA 3R type enclosure that meets the UL 50 for outdoor applications.
- The Enclosure shall be constructed from 16 awg galvanized steel, with a drip shield top and seam free side, front and back.
- The Enclosure shall have a "slip-on" removable front cover held in place with steel screws.
- Enclose shall incorporate pre-punched knockouts for standard trade size conduits up to 1".
- The size of cabinets mounted on an outside wall to serve a smaller building shall be as indicated on the construction plans.
- Quantity: Contractor will provide boxes in the sizes and quantities as shown on the drawings.

B. Metallic Pull Boxes and Terminal Cans

1. NEMA Type 1 – Screw Cover Cans

- Used for indoor use only
- NEMA/EEMAC Type 1, IEC 60529, IP30
- UL 50, 50E Listed; Type 1; File No. E27525, cUL Listed per CSA C22.2 No 40; Type 1; File No. E27525
- 16, 14 or 12 gauge steel or plated steel
- ANSI 61 gray polyester powder paint finish inside and out.
- Minimum size 6x6x4
- Pre-Approved Sizes

Hoffman ASE6X6X4, ASE10X10X4, ASE12X12X4, ASE18X12X4, ASE18X18X4
Hoffman ASE6X6X6, ASE10X10X6, ASE12X12X6, ASE18X12X6, ASE18X18X6, ASE24X18X6, ASE24X24X6

- Provide “NK” for No Knock-Outs as required.
- Provide “AFE” Flush Covers as required.
- Provide “AFDF” Flush Doors on all cans in user accessible areas IE; Data Closets, Electrical Rooms, Janitor Rooms, and Mechanical Rooms.
- Provide “ACLFDF” Lock Kits for all cans in student areas.

2. NEMA 3R Terminal Cans

- Used for outdoor use under-eve, breezeway or parapet
- NEMA/EEMAC Type 3R, IEC 60529, IP32
- UL 50, 50E Listed; Type 3R; File No. E27567, cUL Listed per CSA C22.2 No 94; Type 3R File No. E27567
- 16 gauge galvanized steel
- ANSI 61 gray polyester powder paint finish inside and out over galvanized steel.
- Minimum size 12x12x6
- Hoffman A12R126HCR, A18R186HCR, A20R208HCR, A30R308HCR

3. NEMA 4 Terminal Cans

- Used for outdoor use vertical or Horizontal under-eve, breezeway or parapet
- 16 or 14 gauge steel (see table)
- Seams continuously welded and ground smooth
- Stainless steel door clamps on three sides of door
- ANSI 61 gray polyester powder paint finish inside and out over galvanized steel.
- Minimum size 16x16x6
- Hoffman A16H16ALP, A20H20ALP, A24H24ALP, A36H24ALP

C. Conduit

1. Rigid Steel Conduit

- Rigid steel conduit shall comply with Underwriter's Laboratories UL-6 Specification, ANSI C80.1 and Federal specification WW-C-581E or latest
- revisions. Conduit shall be hot dip galvanized on the exterior, with zinc or enamel on the interior.
- Couplings, locknuts, and all other fittings shall be galvanized or sheardized, waterproof and threaded type only. Rigid conduit shall terminate with two locknuts; one outside and one inside enclosures and specified bushings. No running threads or chase nipples shall be issued without approval.
- Bushings shall be non-metallic for 1 inch and smaller and insulated metallic for conduits larger than 1 inch.
- Galvanized rigid steel conduits (GRC) way be used in all locations. For underground runs in direct contact with earth, conduit shall be wrapped in10mil PVC tape or shall be factory PVC-over-GRS conduit.
- Intermediate metallic conduit (IMC) may be used indoor and outdoor locations, not underground.

2. Electrical Metallic Tubing (EMT)

- EMT conduit shall comply with Underwriter's Laboratories UL 797, ANSI C80.3 and

Federal Specification WW-C-563 or latest revision. EMT shall be galvanized or sheardized.

- Couplings and connectors for EMT shall be galvanized or cadmium plated and shall be of the compression type requiring the tightening of a nut on a gland ring. No die cast type shall be allowed. All connections shall have permanent insulated throats.
- Electrical metallic conduit (EMT) may be used indoor and outdoor locations, not underground, not in areas subject to physical damage, not in concrete slabs, not in hazardous areas, not in masonry walls.

3. Schedule 40 PVC:

   - The minimum conduit trade size allowed for this project will 2". Contractor will increase to the next higher trade size if conduit fill ration will exceed 40%.
   - Conduit shall be Carlon or equal, rated for use with 90° C conductors, UL Listed or approved equal. Material shall comply to NEMA Specification TC-2 (Conduit), TC-3 (Fittings) and UL 651 (Conduit) and 514b (Fittings).
   - Conduit and fittings shall carry a UL label (Conduit - on each 10 foot length; Fittings - stamped or molded on each fitting).
   - Conduit and fittings shall be identified for type and manufacturer and shall be traceable to location of plant and date manufactured. The markings shall be legible and permanent.
   - The Conduit shall be made from polyvinyl chloride compound (recognized by UL) which includes inert modifiers to improve weatherability and heat distortion. Clean rework material, generated by the manufacturer's own conduit production, may be used by the same manufacturer, provided the end products meet the requirements of this specification.
   - The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could mar conductors or Cables.
   - Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
   - Testing and Acceptance Criteria: Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC- 3 and UL-651 and 514. The acceptance criteria shall be given in the same standards.
   - All conduit and fittings shall be solvent cemented in applications in accordance with instructions from the manufacturer.
   - Conduit Spacers
   - High impact spacers shall be used in all multi-conduit duct banks (five or more conduits). The spacers shall conform to NEMA TC-2, TC-6, TC-8, and ASTM F 512.
   - Spacers shall be installed and secured following the manufacturer's suggested guidelines, the BICSI CO-OSP Manual, or TIA/EIA 578, whichever is more stringent.

4. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be interlocked with the suspension rod socket.

5. Pipe racks for a group of parallel conduits shall be galvanized structural steel preformed channels of length as required, suspended on threaded rods and secured thereto with nuts above and below the cross bar. All offsets shall be in the same plane and shall be parallel.

6. Factory made pipe straps shall be one-hole malleable iron or two-hole galvanized clamps.

7. Manufacturer: Appleton, Crouse-Hinds, B-Line, Unistrut, T&B, or an approved equivalent product.

8. Conduit Terminations and Plugs

   - All conduits entering a vault or pullbox shall be equipped with a bell-end securely attached to the structure.

- All metal conduits shall be equipped with a bushing or end collar to protect cable during placement.
- All unused conduits placed on this project or cleaned and modified by the Contractor shall be equipped with reusable rubber or plastic expansion seal plugs in all utility vaults/pull boxes and within all buildings.

9. Conduit Flexible Type

- Flexible conduit "Steel Flex or Aluminum Flex" may only be used for attic j- box to device connection, where specified in the project drawings or with consent of the owner/consultant representative.
- Liquidtight flexible conduit may only be used where specified in the project drawings or with consent of the owner/consultant representative.
- GRC & IMC fittings shall be galvanized rigid steel threaded type. Provide insulated grounding bushings at all enclosures.
- EMT fittings shall be die cast or steel set screw type for dry locations, die cast or steel compression type for wet locations. Provide insulated grounding bushings at all enclosures.
- PVC fittings shall be schedule 40 or schedule 80, provide adapters at all enclosures and transitions to GRC, IMC or EMT conduits.
- Flexible fittings shall be die cast or steel type.
- Liquidtight fittings shall be steel compression type.
- Provide insulated screw on bushings on all conduit connections.
- Provide insulated push on bushings for all stubb-out conduits.
- Quantity: Contractor will provide conduits in the sizes and quantities as shown on the drawings.

10. Textile Innerduct – MaxCell

- Made from White Polyester and Nylon resin polymer
- Standard Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape.
- Detectable Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4- inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape, and a solid copper, polyvinyl color coated conductor (19AWG minimum) for tracing and rated for a minimum of 6 amps and 600 volts. Conductor shall be placed in the sidewall edge fold of the textile sleeve.
- Indoor Textile Innerduct (Riser-listed): Micro (33mm), 2-inch, 3-inch and 4- inch single or multi-cell nylon textile innerduct containing 1250lb polyester flat woven pull tape which meets UL2024A for flame propagation and smoke density values for general applications.
- Plenum-Listed Textile Innerduct: Micro (33mm), 2-inch and 3-inch single or multi-cell nylon textile innerduct containing 200lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces.
- Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile innerducts within a 4-inch inside diameter conduit, e.g.: 4-inch plug with nine holes for cables in a 3 pack (9-cell) configuration
- Termination Bags: Inflation-type bags for sealing and securing around one or more textile innerducts and cables within 2-inch outside diameter or larger conduit.
- Pull Tape: measuring and pulling tape constructed of synthetic fiber, printed with accurate sequential footage marks. Color-coded.
- Duct Water Seal: products suitable for closing underground and entrance conduit openings where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure.
- Approved Textile Innerduct #'s MXC4003, MXR4003 MXC3456, MXP3456, MXR3456 MXC2003, MXP2003, MXR2003 MXC2002, MXP2002, MXR2002

D. Duct Bank Locating Cable (Detectable Warning Tape)

1. Warning tape

- Warning Tape shall be a minimum of 3" wide, orange in color, 4 mils thick, and shall have an imprint as follows:
- "Caution Telephone Cable Buried Below" or,
- "Caution Fiber Optic Cable Buried Below"

E. Inter-duct

1. Plenum

- White or orange Kynar PVDF Resin, a fluoropolymer compound.
- Plenum rated flexible optical fiber/communication raceway.
- Provide wire management in a building for fiber optic and data and communications cabling.
- Recognized per NEC Articles, 770 and 800 for Plenum, Riser and General Purpose Raceway for optical fiber, and telecommunications cables.
- UL Listed
- Meets UL 910 standards for Plenum Optical Fiber/Communications raceways.
- Provide all fittings to form a complete integrated raceway system.
- Extrude raceway from precision extruded PVDF resin
- 1"-2"diameter raceway shall have a 1/4" wide 1250 lb. tensile pull tape preinstalled.
- Shall be available in ¾" through 2" diameters.
- Footage shall be sequentially marked.
- Threaded Aluminum Coupling: Molded Aluminum fitting which connect two pieces of corrugated tubing equipped with threaded ends.
- Quick-Connect Couplings: Molded Part which allows two pieces of 1" diameter corrugated tubing to be quickly snapped together. Available only in 1" diameter.
- Quick-Connect Threaded Male Adapters: Molded fitting which quickly snaps onto a 1" diameter piece of corrugated tubing to produce a threaded end. Available only in 1" diameter.
- Quick-Connect Male Snap-In Adapters: Molded fitting which snaps onto a 1" diameter piece of corrugated tubing to connect to an outlet or switch box. Available only in 1" diameter.
- Metallic Terminal Adapters: Molded metal part which allows a piece of corrugated tubing to connect to metallic conduit and metallic boxes.
- Spool Length: Varies, contractor shall field verify prior to ordering.
- Color: Orange
- Part #: Carlon
  ¾" CE4X1-1000
  1" CF4X1C-1000
  1-1/4" CG4X1C-900
  1-1/2" CH4X1C-1200
  2" CJ4X1C-1400

2. Riser

- Orange polyvinyl chloride (PVC)
- Riser rated Flexible Optical Fiber/Communication Raceway.

- Provides wire management for fiber optic and data and communications cabling in Riser applications and/or General Purpose applications within a building or for direct burial or concrete encasement.
- Recognized per NEC Articles, 770 and 800 for Plenum, Riser and General Purpose applications for optical fiber, and telecommunications cables.
- UL Listed
- Listed under UL 1666 - Standard for Riser Application for Optical Fiber Raceway.
- Provide all fittings to form a complete integrated raceway system.
- Fabricate Raceway from precision extruded PVC resin.
- Kevlar_ pull tape can be preinstalled in the 1" through 2" diameter.
- The footage shall be sequentially marked.
- Shall be available in ¾" through 2" diameters.
- Threaded Aluminum Coupling: molded Aluminum fitting which connect two pieces of corrugated tubing equipped with threaded ends.
- Quick-Connect Couplings: Molded Part which allows two pieces of corrugated tubing to be quickly snapped together. Available only in ½"-1" diameter.
- Quick-Connect Threaded Male Adapters: Molded fitting which quickly snaps onto a piece of corrugated tubing to produce a threaded end. Available only in ½"-1" diameter.
- Quick-Connect Male Snap-In Adapters: Molded fitting which snaps onto a piece of corrugated tubing to connect to an outlet or switch box. Available only in ½"-1".
- Metallic Terminal Adapters: Molded metal part which allows a piece of corrugated tubing to connect to metallic conduit and metallic boxes.
- Schedule 40 Fittings: Molded fitting that is solvent cemented to the raceways. Schedule 40 fittings are commonly used with PVC Schedule 40 rigid conduit.
- Spool Length: Varies, contractor shall field verify prior to ordering.
- Color: Orange
- Part #: Carlon
  ¾" DE4X1-1000
  1" DF4X1C-1000
  1-1/4" DG4X1C-900
  1-1/2" DH4X1C-1200
  2" DJ4X1C-700

3. General Purpose for use in Underground Conduit

- Orange polyvinyl chloride (PVC)
- General Purpose is nonmetallic flexible raceway for use in General Purpose applications only. It is UL Listed and available with tape pre- installed.
- General Purpose raceway is listed to UL 2024 in accordance with the California Electrical Code per Articles 725, 770, 800 and 820 for General Purpose and other cabling optical fiber/telecommunication applications.
- For use in General Purpose areas per Articles 725, 770, 800 and 820 of the CEC.
- Available in sizes 3/4" through 2"
- Pull tape can be factory pre-installed in 1" through 2"
- Outside Diameters meet IPS Dimensions
- Footage sequentially marked
- Spool Length: Varies, contractor shall field verify prior to ordering.
- Color: Orange
- Part #: Carlon
  1" BF4X1B-8000
  1-1/4" BG4X1B-5600
  1-1/2" BH4X1B-4500
  2" BJ4X1B-8000

F. Outlet Boxes

1. Outlet boxes (voice, data and audio visual)

- All boxes shall be 5 in. Square x 2.875 in. Deep Metal Box with Cable Management minimum. As required provide 4-11/16" square by 2-1/8" deep.
  Volume: 64 in3 (1050 cm3)
- Side Knockouts: (1) 1"& (1) 1-1/4" each side
- Listing: C ETL US; for use on Class 2 and Class 3 Remote-Control, Signaling and Power-Limited Circuits only.
- Provide **varied depth** mud ring as required to allow no more than 1/8" gap between wall materials.
- Any unused outlet or j-box shall be equipped with a blank cover.
- Approved Outlet box shall be RANDL Inc. T-55 series

2. Outlet boxes (wall phone, microphone and other devices)

- All boxes shall be 4-11/16" square by 2-1/8" deep minimum.
- Provide **varied depth** mud ring as required to allow no more than 1/8" gap between wall materials.
- Any unused outlet or j-box shall be equipped with a blank cover.

3. Junction boxes

- All boxes shall be 4-11/16" square by 2-1/8" deep minimum.
- Provide **varied depth** mud ring as required to allow no more than 1/8" gap between wall materials.
- Any unused outlet or j-box shall be equipped with a blank cover.

4. Surface Mount boxes

- base has rectangular KO to enable extension from existing single-gang flush wall box and 1/2" and 1" trade size concentric KOs.
- Accepts NEMA Faceplates
- one-gang - 4 3/4" H x 3" W x 2 3/4" D equal to Wiremold # 2344
- two-gang - 4 3/4" H x 4 7/8" W x 2 3/4" D equal to Wiremold # 2344-2

G. Floor Boxes

1. Floor boxes provide the interface between power and communication cabling in an on-grade or above-grade concrete floor where power and communication services are required. Boxes shall provide flush or recessed device outlets that will not obstruct the floor area.

2. Provide floor boxes approved for use in concrete floor construction. Boxes shall be approved for above grade (stamped steel) and on grade (cast iron) applications. Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to meet UL514A and Canadian Standard C22.2 and shall bear the appropriate label. Floor boxes shall conform to the standard set in the California Electrical Code. Multi-compartment box shall have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.

3. Boxes shall be available in one-, two-, or three-gang configurations or a single unit with four independent wiring compartments and available in stamped steel and cast iron versions. Boxes shall be rectangular in shape and available in deep and shallow versions. Boxes shall provide pre-

and post-pour adjustments. Multiple gang boxes shall also provide a removable barrier between the individual compartments for greater capacity when required.

4. Multi-Compartment Boxes: Floor boxes shall be manufactured in stamped steel or cast-iron. Box shall be available in shallow version for stamped steel or cast- iron types and deep version for stamped steel type only. Box shall have four independent wiring compartments that allow up to 4 duplex receptacles and/or communications services.

   - Boxes shall permit a tunneling feature that will allow internal wiring to various compartments. The box shall provide various size conduit openings.
   - Boxes shall be fully adjustable, providing a maximum of 1-7/8 inch pre-pour adjustment, and a maximum of 3/4 inch post-pour adjustment.
   - Boxes shall provide a series of device mounting plates that will accept both duplex power devices, as well as plates that will accommodate connectivity outlets and modular inserts. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.
   - Activation covers shall be die-cast aluminum. Cover finish shall be one of the following, as selected:

     a. textured aluminum finish.
     b. Powder coat finish, color shall be Black.
     c. Powder coat finish, color shall be Brass.

   - Activation covers shall be available in flanged or flangeless versions as selected. Covers shall be available with options for tile or carpet inserts, blank covers, or covers with one or two 1 inch liquid tight openings for furniture feed applications as applicable.
   - Pre-Approved Floor boxes shall be equal to Wiremold RFB-4 & RFB-9 series boxes.
   - Contractor shall provide all required entrance fittings & adapter plates for scope of work depicted.

H. Surface mount raceway “SMR”

1. Non-metallic raceway is an enclosed pathway used for surface distribution of branch circuit electrical wiring, and cabling for voice, data, multi-media, low voltage, and optical fiber. Raceway is typically installed in existing building structures, or after construction is complete. A complete raceway system includes raceway, covers, mounting hardware, various fittings, and outlet boxes installed at specific locations. Specific codes and standards apply to electrical wires and telecommunications cables that are deployed within non-metallic raceway. Codes that are enforced by the local Authority Having Jurisdiction (AHJ) must be observed during construction.

   - Assembly and disassembly of raceway base, cover, and fittings shall require no special tools.
   - Installed fittings shall be designed to overlap the raceway junction to cover exposed or uneven edges.
   - Security caps shall provide enhanced tamper protection by installing over the assembled raceway in desired locations.
   - Raceway shall be designed to accept inline device boxes with either horizontal or vertical faceplate orientations.
   - Device boxes shall have a removable knockout portion to permit raceway entry and exit. Device boxes shall serve as an extension box by removing a single knockout.
   - Device boxes shall be available in standard NEMA single, double, and 3- gang versions. Device box color shall match raceway color.
   - Device boxes shall accommodate various faceplates that accept modular connector inserts or bezels for balanced twisted pair, fiber optic, coaxial, multi-media, and other low voltage cabling connectors.
   - Faceplates for device boxes shall accommodate pre-printed labels for proper electrical

identification, or telecommunications port identification according to ANSI/TIA/EIA-606-A.

- Faceplates shall be available in colors that match the device box and raceway.
- Category rated communications jacks installed in surface box faceplates shall have provisions for snap-in icons for further identification.

2. 5400 Series

- The raceway shall be a two-piece design with a base and snap-on covers. The raceway base shall accept both a single cover that spans the entire base or two individual TwinSnap™ covers. Total width shall be 5.25" [133mm] by 1.75" [44.5mm] deep with an approximate thickness of .095" [2.4mm]. The base and cover shall be available in 8' [2.4m] lengths. The raceway shall be available with two (5400TB) or three (5400TBD) wiring channels. VERIFY WITH OWNER BEFORE USING ANY RACEWAY. IT IS ALWAYS PREFERRED TO HAVE CABLING CONCEALED IN THE WALLS.
- The 5400TB Series Base shall have two wiring channels separated by one integral barrier. Each channel must be large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. The 5400TBD Series Base shall have three wiring channels separated by two integral barriers forming 1/2, 1/4, and 1/4 compartments. One channel must be large enough to accept standard power and communication devices without restricting capacity of the other channels. The 5400C Series Cover shall span the entire width of the base concealing all of the wiring channels. The 5400TC Series Cover shall have flanges for snapping onto the base side walls and center barrier. The cover shall span one-half the width of the base, providing independent access to services.
- A complete line of full capacity corner elbows and tee fittings must be available to maintain a controlled 2" [51mm] cable bend radius which meets the specifications for Fiber Optic and UTP/STP cabling and exceeds the TIA / EIA 569-A requirements for communications pathways. They shall be manufactured of a rigid PVC compound. A full complement of fittings must be available including, but not limited to tees, entrance fittings, cover clips, and end caps. They shall be manufactured of a rigid PVC compound. The fittings shall have a matte texture, in ivory or white colors to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other Wiremold series raceways.
- Device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall provide up to three single- gang openings at one location. Faceplates shall be 5507 Series that match and fit flush in the device plate. They shall be manufactured of rigid PVC compound.
- The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP, STP (150 ohm), fiber optic, coaxial and other cabling types with faceplates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons, as well as write-on station identification labels shall be available.
- If raceway does not exist and plans show raceway to be installed, verify with owner BEFORE any installation occurs. The Owner prefers all cables to be inside the walls, whenever possible. Verify with Owner on location Contractor believes raceway is required.

I. Cable Tray Systems

Provide cable tray system to route power and communications cable distribution for utility needs. Cable tray system shall consist of cable tray and appropriate fittings for a complete installation.

1. Cable tray is to be utilized in locations only as covered in Article 392 of the California Electric Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute.

2. Trays shall be constructed of 6063 T6 and T5 aluminum alloys and shall utilize center lines to indicate all areas where after field cutting of tray, new holes need to be drilled or screws inserted (Center Spine, Twin Spine, Ladder Style and Wall Mounted Trays).

3. Ladder Tray: Cable tray shall be constructed to form an open and accessible compartment to hold the necessary cables. The tray shall be constructed of two components, (1) two longitudinal support rails (side rails) and (2) the rungs. The rail shall be a single aluminum extrusion with extending flanges that provide rung support. The rungs shall have 7/8 inch cable laying surface and be attached with sheet metal screws to the two side rails on 6 inch, 9 inch or 12 inch centers, creating a cable laying area between the rails.

4. Wall Mounted Cable Tray: Cable tray shall be constructed to form an open and accessible compartment to hold the necessary cables which also enables full viewing of the compartment. The tray shall be wall mounted allowing cable lay-in where applicable.

    - Trays shall be constructed with two components, (1) the main support which is the spine and (2) the rungs. The spine shall be a single aluminum extrusion designed with a lower cavity which has extending wings and provides rung support.
    - Rungs shall have a 1 inch cable laying surface, and be attached on 6 inch, 9 inch or 12 inch centers, and protrude from the spine only on one side. The end of the rungs shall be bent upward to the height of 3 inches, 4 inches or 6 inches as applicable forming a 90 degree angle. This creates a cable laying area between the spine and the vertical portion of the rung. The rung shall be designed with a center screw groove along its length to provide a direct connection for rung mounted accessories. The ends of all rungs shall be fitted with a plastic cap to prevent damage to the cable and injury to the installer.
    - For multi-tier wall mounted trays, the lower rungs shall be mounted through the entire vertical distance of the spine and project down, be bent outward, then up from one side only, forming a 'J' hook shape. These rungs shall be fixed in place with a sheet metal screw through the top of the spine which allows for replacement or expansion of the tray area.
    - Top and bottom rungs shall form two or three tiers of cable tray, one above the other, attached to one single support member or spine.
    - Tray shall not have side rails and shall offer an open view of the cables.

5. A full complement of fittings for the cable tray shall be available including, but not limited to, 45 and 90 degree flat, vertical inside and outside elbows, tee and cross fittings, couplings for joining sections of the tray, hangers, end blanks, field- installed dividers and all other components necessary to make the system perform as intended. The fittings and accessories shall be of a compatible material.

6. Ladder Rack Cable Runway

    - Stringers shall be fabricated from ASTM A513 Steel tubing.
    - Rungs shall be fabricated from 3/8”x1 ½” steel channel welded
    - Rungs shall be spaced at 12.0” center to center
    - Ladder Rack shall have a powder coat finished.
    - Ladder Rack shall be individually boxed
    - Ladder rack shall be part of a total system that includes: manufacture bends, wall supports, joining hardware, etc.
    - Ladder Rack shall be grounding per the TIA/EIA 607-A.
    - Ladder Rack shall be UL listed- File number E60548
    - Color: Ladder Rack will be BLACK
    - Quantity: See Drawing for quantity and installation details.
    - Part#: Equal to Cooper B-Line Ladder Rack, PN# SB17U12BFB

7. Wire Basket Cable Runway

- Wire mesh cable tray shall be manufactured from round carbon steel wires that are 5 mm and 6 mm in diameter. Wires shall be welded at intersections to form a 2" x 4" grid pattern. The tray shall be U-shaped with equal height sidewalls.
- Individual tray sections shall be 10' long and 4", 6", 8", 12", 16", 18", 20", or 24" wide. Sidewalls shall be 4" high, as specified below.
- Wire mesh cable tray shall be zinc electroplated after fabrication, galvanized before fabrication (pre-galvanized) or painted black with powder coat paint, as specified below.
- Wire mesh cable tray that is 6" wide or wider shall be UL Classified for suitability as an equipment grounding conductor only. Pre-galvanized trays shall be UL Classified in the United States. Painted tray shall be UL Classified in the United States.
- Ladder Rack shall be grounding per the TIA/EIA 607-A.
- Color: Zinc Electroplate
- Quantity: See Drawing for quantity and installation details.
- Part#: Equal to Chatsworth Products OnTrac

    - Part Number 34821-504, 4" High x 4" Wide x 10' Long.
    - Part Number 34821-506, 4" High x 6" Wide x 10' Long.
    - Part Number 34821-508, 4" High x 8" Wide x 10' Long.
    - Part Number 34821-512, 4" High x 12" Wide x 10' Long.
    - Part Number 34821-516, 4" High x 16" Wide x 10' Long.
    - Part Number 34821-518, 4" High x 18" Wide x 10' Long.
    - Part Number 34821-520, 4" High x 20" Wide x 10' Long.
    - Part Number 34821-524, 4" High x 24" Wide x 10' Long.

- Provide all installation hardware required for installation whether shown on the plans or not. Some of the supports may require design build application and shall be included by the contractor without notice.

    - OnTrac Standard Splice Kit
    - OnTrac Splice Bar
    - OnTrac Splice Washer & Bolt Kit
    - OnTrac Spring Splice Kit
    - OnTrac Clamp Washer
    - OnTrac Carriage Bolt Hardware Kit
    - OnTrac 90° Splice Bar Kit
    - OnTrac Rack-Mount Hook
    - OnTrac Pedestal Clamp Bracket
    - Split Bolt Grounding Clamp
    - OnTrac Cable Tray Divider
    - OnTrac Cover
    - OnTrac Cable Tray Bottom Insert
    - OnTrac Cable Tray Liner
    - OnTrac Tool-Less Radius Drop
    - OnTrac Large Radius Drop
    - OnTrac Vertical Radius Bracket
    - OnTrac Electrical Box Bracket
    - OnTrac Conduit Bracket
    - OnTrac Auxiliary Side Bracket
    - OnTrac Section Support Bracket
    - OnTrac Label Holder
    - OnTrac Cable Tray Cutting Tool
    - Threaded Rod, 3/8-16
    - Threaded Rod Coupling Kit, 3/8-16
    - Threaded Rod I-Beam Clamp, 3/8-16

- Hex Nut, 3/8-16
- Split Lock Washer, 3/8”
- Washer, 3/8”
- Hex Lag Screw, 3/8-7 x 2” Long
- Hex Lag Screw, 1/4-10 x 2” Long
- Split Lock Washer, 1/4”

- Provide all support systems required for installation whether shown on the plans or not. Some of the supports may require design build application and shall be included by the contractor without notice.

  - OnTrac Wire Mesh Cable Tray System Supports
  - OnTrac Ceiling Center Support Bracket
  - OnTrac Ceiling Edge Hanger
  - OnTrac Ceiling Trapeze Support Bracket
  - OnTrac Wall/Ceiling C-Support Bracket
  - OnTrac Wall L-Support Bracket
  - OnTrac Wall Triangle Support Bracket
  - OnTrac Wall-Mount Angle
  - OnTrac Under Floor Support
  - OnTrac Under Floor C-Bracket
  - OnTrac Pedestal Clamp Bracket Kit

J. Cabling Support System

1. Telco Backboards

- Backboards shall be 4’ x 8’ x .75” void free plywood (ACX Plywood with the “A” side turned out).
- The plywood shall be painted with two coats of white fire retardant paint.
- Cut full size sheet to required size for application type.

2. J-Hooks

- Cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
- Cable supports shall have flared edges to prevent damage while installing cables.
- Cable support system shall provide fasteners that allow them to be mounted to wall, concrete, joist, tee-bar wire, treaded rod, beams and raised floor supports.
- Fasteners shall have the ability to either be factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- Fastener to with one non-continuous cable support, factory or jobsite assembled.
- Color: NA
- Quantity: Contractor will provide quantities of j-hooks and hanger accessories in the amount necessary to support all horizontal cabling every 14” – 28”. The load per hook shall not exceed the Owner’s 40% fill ratio. All hooks shall have a retainer clip installed as part of the hook. Verify with Owner as to what 40% fill is.
- Part#: ERICO CAT425, Cooper B-Line BCH12, BCH21, BCH32, BCH64 and accessories.

3. In-ceiling support brackets

- Above-ceiling cable termination locations shall be either wall-mounted or suspended from structure above the drop ceiling. Cables or terminations shall not rest on ceiling grid or equipment above ceiling grid.
- For Wireless Access Points and other above-ceiling-mounted communications devices,

cables shall land in an above-ceiling bracket which is affixed to dedicated cable support hardware.

- Two category-rated jacks may be installed in each above-ceiling bracket. Each above-ceiling bracket will hold a 2-port Surface-Mount Box or 1-U MOS SMB for multimedia applications.
- For wall-mounted device locations (above or below ceiling), devices needing to be mounted directly to a backbox will utilize the in-wall mounting bracket to secure the jack inside the backbox.
- One category-rated jack can be installed in each in-wall backbox jack mounting bracket. For devices requiring (2) category-rated jacks, (2) in-wall brackets must be used.
- Part #:
  Leviton QuickPort In-Ceiling Bracket, rod/wire hanger, 49223-CBC Leviton QuickPort In-Ceiling Bracket, accepts beam and screw mounts, 49223-CB0 Leviton QuickPort In-Wall Bracket, 49223-BA5 (pack of 5)

K. Pull Rope

1. Pulling Ropes (Mule tape)

   - Pull ropes shall be 1/2" flat tape with a minimum tensile strength of 1200 Ibs.
   - Ropes shall be pre-lubricated, woven polyester or aramid fiber tape made from low friction, high abrasion resistant yarns providing a low coefficient of friction. Tape shall be printed with sequential footage markings for accurate measurements.

2. Empty Conduits

   - Pull rope shall be new 1/2” flat tape with a minimum 1200 lb. tensile strength.
   - Every empty conduit shall be equipped with a pull rope secured to the duct plug at each end.

3. Installed with Cables:

   - Pull rope shall be new 1/2” flat tape with a minimum 1200 lb. tensile strength.
   - Contractor is required to install a pull rope into every conduit that they pull cabling in.

2.2 FIRE STOP SYSTEMS

A. General

1. Sleeves shall be 2”, 3” or 4" EMT or smaller. All cables penetrating walls must be sleeved.
2. Sleeves shall maintain a 40% conduit fill ratio.
3. Sleeves must be supported or attached at walls by apparatuses meant to do so. All sleeves shall be rigidly and properly supported.
4. Sleeves must extend past inaccessible areas.
5. Sleeves must be protected by a U.L. rated system at all firewalls designated on the construction drawings.
6. Fire stopping shall be a material, or combination of materials, to retain the integrity of time-rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases. It shall be used in specific locations as follows:

   - Duct, cables, conduit, piping, and cable tray penetrations through floor slab and through time-rated partitions or fire walls.
   - Openings between floor slab and curtain walls, including inside hollow curtain walls at the

floor slab.
- Penetrations of vertical service shafts.
- Openings and penetrations in time-rated partitions of fire walls containing fire doors.
- Locations where specifically shown on the drawings or where specified in other sections of the Standards.

7. Fire stopping materials shall be asbestos free and capable of maintaining an effective barrier against flame, smoke, and gasses in compliance with requirements of ASTM E 814, and UL 1479. Only listed fire stopping material acceptable to State, County, and City codes shall be used.

8. The rating of the fire stops shall in no case be less than the rating of the time rated floor or wall assembly.
9. All Fire stopping Locations (FSL) shall be labeled within 12" of the fire stopping material on each side of the penetrated fire barrier. The format for the Fire stopping Location identifier shall display the Telecom Room floor number, the Fire stopping Location number, and the hour rating of the fire rating system (e.g. 1-FLS001 (2)). Each fire stopping location shall be identified with a fire stopping warning label. The label shall include the manufacturer of the product, the installer and company name, the UL number for the product, the rating of the material, the installation date, and the number and type of cables passing through the opening. The fire stopping warning label can include the fire stopping location identifier, eliminating the need for a separate label. Penetration modifications requiring the repair/re-installation of the fire stopping material require the addition of a new fire stopping warning label. No previous fire stopping warning labels shall be removed or obscured by new labels. In the event the penetration is completely cleaned of existing fire stopping material, and new material is installed, the previous label shall be removed or obscured completely.
10. Manufacturers; Specified Technologies Inc., 3M & Hilti

- SSS - intumescent sealant
- SSP - putty and putty pads
- SSAMW - mineral wool
- IC 15WB+ - intumescent sealant
- CP 25WB+ - intumescent sealant
- Fire Barrier Moldable Putty+ - putty and putty pads
- FS-ONE - intumescent sealant
- CP 618 - putty and putty pads.

B. Single Entry System

- The fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.
- Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.
- Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).
- Quantity: See Drawing for quantity and installation details.
- Part#: Equal to STI, PN# SSS100

C. Re-Enterable Fire Stop System

- The re-enterable fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.
- No additional fire stopping material shall be required to obtain proper fire stopping.
- The system shall offer full fire resistance whether it is empty or 100% visually filled.
- The system shall be self-contained, and shall automatically adjust to differing cable loads.
- The system shall allow add, moves, and changes without additional materials.
- All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate re-enterable fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.
- Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).
- The system shall be gang-able using wall plates for additional capacity.
- Quantity: See Drawing for quantity and installation details.
- Part #: Equal to STI STI PN# EZDP33FWS STI PN# EZDP33WR

2.3 GROUNDING/BONDING SYSTEMS

A. Grounding and Bonding Equipment

1. Telecommunications Main Grounding Busbar (TMGB)

- Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
- The buss bar shall be 4” (100 mm) high and 12” (300 mm) long and shall have 18 attachment points (two rows of 9 each) for two-hole grounding lugs.
- The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 15 lugs with 5/8” (15. 8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers.
- The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4” (100 mm) standoff from the wall.
- The busbar shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Telecommunications Main Grounding Busbar: Part Number 40153-012, 12” x 4” (300 mm x 100 mm) Telecommunications Main Grounding Busbar, UL Listed.

2. Telecommunications Grounding Busbar (TGB)

- Telecommunications Grounding Busbar (TGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
- The busbar shall be 2” (50 mm) high and 10” (250 mm) long and shall have 7 attachment points (one row) for two-hole grounding lugs.
- The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 4 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers.
- The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4” (100 mm) standoff from the wall.
- The busbar shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:

- Chatsworth Products, Inc. (CPI),
- Telecommunications Grounding Busbar:
  Part Number 13622-010, 10" x 2" (250 mm x 50 mm) Telecommunications Grounding Busbar, UL Listed.

3. Horizontal Rack Busbar

- Horizontal rack-mount busbar shall be constructed of 3/16" (4.7 mm) thick by 3/4" (19.1 mm) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
- Bar shall be 19" EIA or 23" rack mounting width (as specified below) for mounting on relay racks or in cabinets.
- Bar shall have eight 6-32 tapped ground mounting holes on 1" (25.4 mm) intervals and four 0.281" (7.1 mm) holes for the attachment of two-hole grounding lugs.
- Each bar shall include a copper splice bar of the same material (to transition between adjoining racks) and two each 12-24 x ¾" copper-plated steel screws and flat washers for attachment to the rack or cabinet.
- Bar shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Horizontal Rack Busbar: Part Number 10610-019, Ground Bar for 19" Rack.

4. Two Mounting Hole Ground Terminal Block

- Ground terminal block shall be made of electroplated tin aluminum extrusion.
- Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
- The conductors shall be held in place by two stainless steel set screws.
- Ground terminal block shall have two 1/4" (6.4 mm) holes spaced on 5/8" (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
- Ground terminal block shall be UL Listed as a wire connector.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Two Mounting Hole Ground Terminal Block:
- Part Number 40167-001, Two Mounting Hole Ground Terminal Block, 1 each
- Compression Lugs
- Compression lugs shall be manufactured from electroplated tinned copper.
- Compression lugs shall have two holes spaced on 5/8" (15.8 mm) or 1" (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
- Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
- Compression lugs shall be UL Listed as wire connectors.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Compression Lugs:
- Part Number 40162-901, Compression Lug, #6 Awg, 5/8" (15.8 mm) hole spacing, 1 each.
- Part Number 40162-903, Compression Lug, #6 Awg, 1" (25.4 mm) hole spacing, 1 each.
- Part Number 40162-904, Compression Lug, #2 Awg, 5/8" (15.8 mm) hole spacing, 1 each.
- Part Number 40162-907, Compression Lug, #2 Awg, 1" (25.4 mm) hole spacing, 1 each.
- Part Number 40162-909, Compression Lug, 2/0 Awg, 1" (25. 4 mm) hole spacing, 1 each.
- Part Number 40162-911, Compression Lug, 4/0 Awg, 1" (25.4 mm) hole spacing, 1 each.

5. Antioxidant Joint Compound

- Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Antioxidant Joint Compound:
- Part Number 40168-101, Antioxidant Joint Compound, Copper-to-Copper Connections, .5 oz, 1 each.
- Part Number 40168-801, Antioxidant Joint Compound, Copper-to-Copper Connections, 8 oz, 1 each.
- Part Number 40166-101, Antioxidant Joint Compound, Aluminum-to- Aluminum or Aluminum-to-Copper Connections, .5 oz, 1 each.
- Part Number 40166-801, Antioxidant Joint Compound, Aluminum-to- Aluminum or Aluminum-to-Copper Connections, 8 oz, 1 each.
- Part Number 40168-150, Antioxidant Joint Compound, Copper-to-Copper Connections, .5 oz, 50 each.
- Part Number 40168-812, Antioxidant Joint Compound, Copper-to-Copper Connections, 8 oz, 12 each.
- Part Number 40166-150, Antioxidant Joint Compound, Aluminum-to- Aluminum or Aluminum-to-Copper Connections, .5 oz, 50 each.
- Part Number 40166-812, Antioxidant Joint Compound, Aluminum-to- Aluminum or Aluminum-to-Copper Connections, 8 oz, 12 each.

6. C-Type, Compression Taps

- Compression taps shall be manufactured from copper alloy.
- Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool
- Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
- Compression taps shall be UL Listed.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Compression Taps:
- Part Number 40163-001, Compression Tap, #6 AWG Solid Run to #6 AWG Solid Tap, 1 each.
- Part Number 40163-007, Compression Tap, 2/0 Stranded Run to 2/0 Stranded Tap, 1 each.

7. Pipe Clamp With Grounding Connector

- Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.
- Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be the same size.
- Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1" to 6" (.75" to 6.63" in diameter), as stated below.
- Pipe clamp shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Pipe Clamps:
- Part Number 40170-002, Pipe Clamp, for 1" to 1-1/4" pipe, 1 each.
- Part Number 40170-003, Pipe Clamp, for 1-1/2" to 2" pipe, 1 each.
- Part Number 40170-004, Pipe Clamp, for 2-1/2" to 3" pipe, 1 each.
- Part Number 40170-005, Pipe Clamp, for 3-1/2" to 4" pipe, 1 each.
- Part Number 40170-006, Pipe Clamp, for 5" to 6" pipe, 1 each.

8. Equipment Ground Jumper Kit

- Kit includes one 24”L insulated ground jumper with a straight two hole compression lug on one end and an L-shaped two hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.
- Ground conductor is an insulated green/yellow stripe #6 AWG wire
- Lugs are made from electroplated tinned copper and have two mounting holes spaces .5” to .625” apart that accept 1/4” screws.
- Jumper will be made with UL Listed components
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Equipment Ground Jumper Kit:
- Part Number 40159-010, Equipment Ground Jumper Kit, 1 each.

B. Communications raceways, backboards and rack systems

1. The conduit system must be permanently and effectively grounded, in accordance with Title 24 of the California Code of Regulations, California Electric Code #250, and National Electric Code or as required by local AHJ. If in confusion or conflict the most stringent specification shall apply.
2. Provide as a minimum a #1/0awg THHN conductor in conduit from the main building grounding point to a ¼” x 4” x 5.25” telecommunications grounding bus bar(TGB) at every backboard.
3. Provide as a minimum #6awg green THHN conductor from each equipment rack, cable tray or wall mounted equipment to a TGB.

PART 3 – EXECUTION

3.1 GENERAL

A. Permits and Licensing

1. Contractor is responsible to procure all necessary permits before the commencement of their work to the city or state agencies as required. It is the contractor’s responsibility to provide all documentation to the AHJ.
2. Contractor is responsible to procure all necessary licenses for the city or state they are commencing the work in, before the commencement of their work begins.
3. Contractor to procure all encroachment permits as it pertains to the work described in these documents.
4. No person may access or enter in any way, an underground vault or confined space without the training, staff, and safety equipment defined on the confined space permit. Accessing these spaces without a valid permit or without the required support services will be cause for an order to stop work until all violations are resolved and may result in a fine or suspension of the workers involved.

B. Safety

1. All federal (OSHA), state, and local safety rules, will be enforced at all times during the duration of the project. It is the responsibility of the Contractor to conduct frequent inspections of the job site to ensure compliance.

3.2 INSTALLATION

A. INTRA-BUILDING PATHWAYS

A. COMMUNICATION VAULTS

1. Site Access

- The general contractor shall be responsible for providing adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete units.

2. Installation

- Precast concrete units shall be installed to the lines and grades shown in the contract documents or otherwise specified.
- Precast concrete units shall be lifted by suitable lifting devices at points provided by the precast concrete producer.
- Precast concrete units shall be installed in accordance with applicable industry standards. Upon request, the precast concrete producer shall provide installation instructions.
- Field modifications to the product shall relieve the precast producer of liability regardless if such modifications result in the failure of the precast concrete unit.

3. Watertightness

- Where watertightness is a necessary performance characteristic of the precast concrete unit's end use, watertight joints, pipe-entry connectors and inserts should be used to ensure the integrity of the entire system.

B. CONDUIT

1. All conduit shall be routed parallel or perpendicular to walls.

2. All conduit shall be installed in accordance with NEMA "Standard of Installation" and shall meet applicable local and California building and electrical codes or regulations.

3. Conduit runs shall not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull boxes. No conduits may enter a pull box at a 90 degree angle. They are not to be installed into the side of a pull box. All conduits must enter the ends of the pull box.

4. All conduits entering a building from outside shall be plugged with reusable stoppers to eliminate the entrance of water or gases into the entrance room. Building entrance conduits shall slope downward away from the building to reduce the potential of water entering the building. All building penetrations are to be sealed from wall to wall and on the outside and inside of the penetrations.

5. All conduits penetrating a fire or smoke barrier shall be fully sealed between the conduit and the actual penetration following manufacturer's recommendations. Contractor shall label each fire stop location with the manufacturer's identification number of the product used and shall provide the inspector copies of each products system configuration

6. No communications outlet boxes shall be "daisy-chained." Each communications outlet shall be served by a separate 1-inch (minimum) conduit.

7. In rooms with a drop or false ceiling, communications outlets shall be served by a 1-inch conduit stubbed six inches above the false ceiling, angled toward the cable tray or open access area, and be equipped with a compression fitting and plastic bushing. All stubs shall be marked “Comm”.

8. All conduit shall be equipped with an approved water or barrier seal in building access points.

9. All conduits which utilize fabric mesh innerduct, willhave the innerduct installed first, and then the appropriate cables installed within the channels of the innerduct.

10. No communications conduit shall contain more than 180 degrees of bend without the use of a pullbox. Pullboxes must be approved by Engineer of Record to ensure proper sizing and conduit entry placement.

11. In areas where hard lid ceilings are in place, all conduits are to run to accessible location or to cable tray.

12. Provide labels at both ends of conduits to identify location of far end.

C. STATION CABLE SUPPORT SYSTEM

1. All station cable support systems shall be braced for zone four seismic activity.

2. In suspended ceiling and raised floor areas where duct, cable trays, or conduit are not available, station cables shall be bundled with Velcro straps at appropriate distances.

3. Velcro straps shall not be over tightened to the point of deforming or crimping the cable sheath.

4. Velcro straps shall be UL listed, rated for low smoke, and certified for use in a plenum environment.

5. The station cable support system components shall be firmly attached to the existing building structure and installed not more than five feet apart.

6. The station cable support system components shall be installed to provide at least three (3) inches of clear vertical space between the cables/optics and the ceiling tiles.

7. The station cable support system components shall be spaced to prevent the cables/optics from sagging or buckling.

8. No more than eighteen (18) Category 6 cables shall be supported by a J - hook.

9. No more than thirty (30) Category 6 cables shall be supported by triangular galvanized metal bracket.

10. The station cable support system shall be clearly and neatly labeled per TIA/EIA 606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

D. Raceways

1. All dual channel raceway shall be installed with a complete end-to-end channel for future power service installation.

2. The raceway shall be stubbed above the false ceiling space and capped so that each section of raceway can be connected to a power service in the future without a requirement to add raceway to visible portions of the system. If no false ceiling space is available, the power channel is to be stubbed up and capped next to the point at which the communication services enter the room.

E. Cable Tray

1. The Contractor will be responsible for placement of the cable tray in concert with other trades, allowing sufficient room for the cable installers to gain access to all portions of the tray system. Cable tray location shall be coordinated with open ceiling areas, access panel locations, and feeder conduit positions to provide an accessible cable pathway throughout the facility.

2. All metallic trays must be grounded and may be used as a ground conductor. Provide #2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component. Trays used as an equipment grounding conductor must be clearly marked.

3. Trays shall be bonded end-to-end.

4. Trays shall enter distribution rooms a minimum or six inches into the room, then utilize a drop out to protect station cables from potential damage from the end of the tray.

5. Cable trays shall be placed a minimum of six (6) inches from any overhead light fixture and twelve (12) inches from any electrical ballast. A minimum of eight (8) inches of clearance above the tray shall be maintained at all times. All bends and T-joints in the tray shall be fully accessible from above (within 1 foot). Trays shall be mounted no higher than twelve (12) feet above the finished floor and shall not extend more than eight (8) feet over a fixed ceiling area.

6. A separate conduit sleeve (minimum of four inches) must be provided as a pathway through any wall or over any obstruction (such as a rated hallway) from the cable tray into any room having a communications outlet.

7. The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers' guidelines. Sound deadening material shall be provided and installed after installation of cable.

8. In rooms without a drop ceiling (open to the structure), the cable shall be mounted as high as possible to provide the greatest clearance above the finished floor, but within the limits in (e) above.

F. Wire Mesh Cable Tray

1. Provide all components of the tray system (tray, supports, splices, fasteners, and accessories) from a single manufacturer.

2. Wire mesh cable tray shall be secured to the structural ceiling, building truss system, wall or floor using manufacturer's recommended supports and appropriate hardware as defined by local code or the authority having jurisdiction (AHJ).

3. When the pathway is overhead, wire mesh cable tray shall be installed with a minimum clearance of 12" (300 mm) above the tray. Leave 12" (300 mm) in between the tray and ceiling/building truss structure. Multiple tiers of wire mesh cable tray shall be installed with

a minimum clearance of 12" (300 mm) in between the trays. When located above an acoustical drop ceiling, wire mesh cable tray shall be installed a minimum of 3" (75 mm) above the drop ceiling tiles.

4. When installed under a raised floor, wire mesh cable tray shall be installed with a minimum 3/4" (19 mm) clearance between the top of the tray and the bottom of the floor tiles or floor system stringers, whichever are lower in elevation. Maintain a 3" (75 mm) clearance between trays wherever trays cross over.

5. Wire mesh cable tray shall be supported every 6' (1.8 m) of span or less. Support wire mesh cable tray within 2' (0.6 m) of every splice and intersection. Support intersections on all sides. Support wire mesh cable tray on both sides of every change in elevation/direction. The weight of the load on the cable tray must not exceed the stated limits per span in the manufacturer's published load table. Use additional supports where needed.

6. Secure wire mesh cable tray to each support with a minimum of one fastener. Follow the manufacturers' recommended assembly, splice and intersection- forming practices.

7. Use installation tools and practices recommended by the manufacturer to field fabricate wire mesh cable tray intersections and changes in elevation. Use side- action bolt cutters with an offset head to cut wire mesh cable tray.

8. Wire mesh cable tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the wire basket tray and a minimum #6 grounding wire or as recommended by the AHJ. Follow UL Classified splicing methods recommended by the manufacturer, ground the tray per NEC requirements and verify bonds at splices and intersections between individual cable tray sections. Cable pathway should be electrically continuous through bonding and attached to the TGB.

9. The quantity of cables within the tray will not exceed a whole number value equal to 50% of the interior area of the tray divided by the cross-sectional area of the cable. Cable fill will not exceed the depth of the cable tray's side rail [2" (50 mm), 4" (100 mm) or 6" (150 mm)].

10. The combined weight of cables within the tray will not exceed stated load capacity in manufacturer's specifications.

11. Separate different media type within the tray. Treat each type of media separately when determining cable fill limits.

12. When pathways for other utilities or building services are within 2' (0.6 m) of the wire mesh cable tray, cover the tray after cables are installed.

G. Pull boxes

1. Pull boxes shall be installed in easily accessible locations.

2. Pull boxes installed as part of a horizontal cabling pathway shall be installed immediately above suspended ceilings, where possible.

3. Pull boxes shall not be used for splicing cable.

4. Pull boxes shall be placed in conduit runs that exceed 100 feet or which require more than two 90 degree bends. The pull boxes shall be located in straight sections of conduit and must not be used for a right angle bend. Installation shall allow cable to pass through from one conduit to another in a direct line.

5. Pull boxes must have a length at least 12 times the diameter of the largest conduit.

B. EXISTING OUTLET BOXES, RACEWAYS, AND CONDUITS

A. Existing recessed boxes and concealed station conduits may only be re-used as a pathway for a new outlet per the criteria below:

1. Existing recessed single-gang box with a ¾ inch diameter station conduit: One new voice or data outlet (1 cable maximum).

2. Existing recessed single-gang outlet with a 1 inch diameter station conduit: One new voice/data outlet or one new voice/data/fiber outlet. (3 cables maximum) (Only acceptable in offices and classrooms where wire cannot be fished in existing walls.) For outlets with fiber cable terminations, faceplates must be equipped with a spool to provide for a maintenance loop per manufacturer's specifications.

C. GROUNDING AND BONDING SYSTEMS

A. Grounding and bonding - GENERAL

1. Installation: The Contractor shall provide grounding and bonding in accordance with the requirements of NFPA 70, IEEE 142, TIA/EIA 568, TIA/EIA 607, state and local codes, the campus standards and to requirements specified herein. Codes shall be complied with as a minimum requirement, with these specifications prevailing when they are more stringent.

2. Bonding

(a) Metallic conduits, wireways, metal enclosures of busways, cable boxes, equipment housings, cable racks and all non-current carrying metallic parts of the installed telecommunications services shall be grounded with #6 AWG copper wire. The metallic conduit system shall be used for equipment and enclosure grounding but not as a system ground conductor.
(b) All metallic conduit stub-ups shall be grounded, and where multiple stub- ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
(c) Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together. The Contractor shall use #6 AWG bare copper conductors.
(d) The Contractor shall bond telecommunications equipment and busbars separately.

B. Signal Reference Grounding and Bonding

1. Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:

(a) Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of TIA/EIA 607. The communication ground shall not ground any other equipment or be connected to any potential high voltage source. All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG copper wire.
(b) The Contractor shall provide, as a minimum, a continuous #3/0 AWG green electrical conductor connected to a 1/4" x 4" x 5.25" telecommunications grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.
(c) The ground wires from each individual IDF shall be routed directly to the Building

Distribution Frame (BDF), terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 12" dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #3/0 AWG ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.

2. Riser/Tie Cable Bonding

(a) There shall be no bonding between the entry cable and the inside riser or distribution cable.
(b) All riser and tie cable shields shall be bonded into a single continuous path end-to-end and grounded on each floor in which pairs leave the sheath. Cable shields shall be grounded to the signal reference ground provided in each telecommunication space.

C. Grounding and Bonding Testing and Inspection Procedures

1. As an exception to requirements that may be stated elsewhere in these documents, the Inspector of Record shall be given five (5) working days' notice prior to each test. The Contractor shall provide all test equipment and personnel and shall provide written copies of all test results.

2. Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.

3. The Contractor shall provide personnel and test equipment for point-to-point resistance tests before connecting equipment. Perform point-to-point tests in each building to determine the resistance between the main grounding system and all BDF/IDF ground bus bars. Investigate and correct point-to-point resistance values that exceed 0.5 ohm. The Contractor shall record resistance measurements at all test point locations.

D. INFORMATION OUTLETS

A. GENERAL REQUIREMENTS

1. Station outlets shall be mounted securely at work area locations.

2. Station outlets shall be located so that the cable required to reach the desktop equipment is no more than 10 feet long.

3. Station outlets should not be "daisy-chained."

4. Outlets shall be mounted as follows:

(a) Wall phone: 48 inches above the finished floor.
(b) Standard voice/data outlet: 15 inches above the finished floor.
(c) Wall-mounted video outlet: 78 inches above the finished floor.
(d) Counter top: 6 inches above the counter top.

B. MODULAR FURNITURE TELECOMMUNICATIONS OUTLETS

1. The Contractor shall provide and install all components and labor necessary to completely install, test, and document voice and data telecommunications outlets at each modular furniture workstation location.

2. Category 6 station cable shall be placed from the BDF, through the riser sleeves, through the cable tray system into the conduit, ceiling or floor poles, etc. into the furniture to be served.

3. The Contractor shall coordinate the telecommunications and electrical installation so that the modular furniture is served from the joint signal/power floor monuments or joint power pole in a consistent manner. The Contractor shall provide and install all fittings, flex conduit, adapter plates, and telecommunications cable and components necessary to install Category 6 station cable from the consolidation point box, through the ceiling or floor monument or pole, into the furniture raceway, and to the final user outlet location (including jacks, adapters, and faceplates).

4. The telecommunications installers shall coordinate with the electrical drawings for the number and location of user voice and data outlets.

5. Labels shall be numbered according to a scheme developed in consultation with the owner's representative. Owner to approve label scheme prior to printing.

E. GROUNDING AND BONDING

1. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor.
2. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

3. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB).

4. The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

5. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

6. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape.

7. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

8. Wall-Mount Busbars

   - Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
   - Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
   - Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the

busbar with antioxidant to help prevent corrosion at the bond.

- The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

9. Rack-Mount Busbars and Ground Bars

- When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack- mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.
- Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.
- Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

10. Ground Terminal Block

- Every rack and cabinet shall be bonded to the TMGB or TGB.
- Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
- Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

11. Pedestal Clamp

- At minimum, bond every sixth raised access floor pedestal with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed according to the manufacturer's recommendations.
- If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.
- Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.
- Remove insulation from conductors where wires attach to the pedestal clamp.

12. Pipe Clamp

- Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed according to the manufacturer's recommendations.
- Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.
- Remove insulation from conductors where wires attach to the pipe clamp.

13. Equipment Ground Jumper Kit

- Bond equipment to a vertical rack-mount busbar or groundbar using ground jumper according to the manufacturer's recommendations.
- Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar or groundbar to help prevent corrosion at the bond.

F. FIRE STOP SYSTEM

1. The fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.

2. Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

3. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.

4. Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).

3.3 SYSTEM CLOSEOUT AND AS-BUILT DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each construction phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The As-Built drawings are to include conduit routes, utility vault/pull box locations, surface mount enclosure locations, PVC to GRC transition points and the approved labeling identifiers. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD 2008) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

END OF SECTION

SECTION 27 10 00 - STRUCTURED CABLING SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing a Structured Cabling Plant.

B. The Cabling System as described in this document is comprised of cabling, infrastructure and termination hardware to provide an approved TIA/EIA Data Networking and Voice Communication Structured Cabling System.

C. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.

D. 271000 contractors shall be complete with work including all testing and labeling prior to 272000 contractor work start. Owner requires a minimum of 5 days to review test documents prior to network start up.

1.2 CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

A. Safety and Indemnity

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 “1.5 A. Safety & Indemnity”.

B. Contractor Qualifications

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 “1.5 B. Contractor Qualification”.

C. Quality Assurance

1. Contractor shall comply with all requirements as specified in Section 270000 “1.5 C. Quality Assurance”.

D. Warranty

1. Contractor shall comply with all requirements as specified in Section 270000 “1.8. Acceptance & Warranties”.

2. The bid package shall be accompanied by a warranty commitment binding the awarded contractor and manufacturer to a Lifetime Structured Cabling Warranty with guaranteed performance criteria set forth in this document and/or set forth by the Manufacturer. Contractor must be trained and certified in the installation of the Manufacturer system proposed. Contractor shall submit proof of current certification in the Certified Installer Program as a Premier or Authorized Network Installer in order to install and fully warrant the Cabling System. Copy of current Certificate must be included in Proposal if not already on file with Architect/Consultant/Owner.

3. A Lifetime warranty (or 25yr minimum) for the structured cabling system shall be provided for an end-to-end permanent link model installation which covers the performance of the cable,

connecting hardware and the labor cost for the repair or replacement of the link.

4. Links failing test parameters or producing marginal pass results will be retested or replaced at Contractor expense until link test results passing TIA/EIA Standard parameters for the category rating or better are achieved.

5. Warranty application is to be submitted in advance of the project start, and full test reports shall be delivered to Manufacturer within 15 days of project completion. Lifetime Manufacturer warranty processing is to be completed by Contractor and warranty certificate delivered to owner upon project completion.

1.3 SUBMITTAL DOCUMENTATION

A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270000 “1.6 Submittal Documentation”.

1.4 EQUIVALENT PRODUCTS

A. All Products Leviton, Berk-Tek, Superior Essex, and Chatsworth form the basis of design for this Specification. Part numbers, where provided, exemplify the feature set expected to be provided for this Structured Cabling Plant.

B. Pre-Approved Equals:

1. None, all alternate materials must be submitted for approval prior to bid.

C. Structured cabling manufacture system warranties shall be Limited Lifetime or 25 year.

D. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 270000 “1.7 Equivalent Products”.

1.5 TYPICAL CONFIGURATIONS

A. All room configurations are based on the “Learning Wall” and entry door. All locations shall be installed per plan. Classrooms shall have on average 17 Cat6 cables in each room;

1. Entry door shall have ONE Cat6 cable for IP wall phone (one voice).

2. Four (4) Cat6 cables, with two on each side of the whiteboard (two data, two voice)

3. Student work area shall have eight (8) Cat6 cables (8 data)

4. Ceiling area shall have four (4) Cat6 cables (one for the A/V projector, one for the A/V switcher, and two for wireless access point). A red colored dot is to be placed on the ceiling grid to mark the location of these four cables.

5. Depending on the orientation of the room, two additional Cat6 cables may be added to allow for teacher flexibility.

B. Computer labs shall have 48 Cat6 cables in each room

1. Entry door shall have ONE Cat6 cable for IP wall phone (one voice).

2. Computer labs shall have FORTY Cat6 cables.

3. Standard A/V classroom install is included: A/V Control Panel, two input modules, and either wall or pole mounts.

4. Ceiling area shall have four Cat6 cables (one A/V projector, one A/V switcher, two wireless access point). A red colored dot is to be placed on the ceiling grid to mark the location of these four cables.

5. Three Cat6 for the teacher (phone, computer, and printer).

C. All rooms shall be field verified prior to installation.

PART 2 – PRODUCTS

2.1 WORK AREA SUBSYSTEM

The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:

- Patch Cords
- Modular Inserts and Jacks
- Faceplates

1. Category 6 and Category 6A Outlet Patch Cords

- *OWNER PROVIDED*

B. Modular Inserts and Jacks

1. Category 6A Keystone Jack (for Wireless and other uses as specified)

- Jacks must meet or exceed the Category 6A standard.
- Jacks shall be 8-position 8-conductor RJ45-style and must have "retention- force technology" or equivalent feature to prevent time damage over the life of the jack regardless of use
- Jacks shall be 8 position un-keyed
- Jack shall be rear-terminated industry- standard 110 IDC. Lead-frame jacks shall not be used in this Cable Plant.
- Jacks shall have a designation indicating Category 6A on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code.
- Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
- Jacks shall terminate 22-26 AWG stranded or solid conductors.
- Jacks shall be compatible with single conductor 110 impact termination tools.
- Jacks shall have an attached color coded wiring instruction label housed between the IDC termination towers.
- Jacks shall be manufactured in the USA
- Jacks shall be compatible with TIA/EIA 606 color code, and have removable high-visibility color labels designating pair locations. Split-colored T568A/B labels are not

approved.

- Jacks shall utilize pair-separation towers for ease of untwisting pairs, and shall employ a snap-on rear termination cover designed for suppression and isolate of cross-talk of neighboring connectors.
- Jacks will be terminated according to theT568B wiring scheme.
- Color:
  Data Jacks will be BLUE
  Voice Jacks will be WHITE
  Wireless Jacks will be YELLOW
  A/V Jacks will be GRAY
  Camera Jacks will be PURPLE
- Quantity: Contractor will provide and install one jack for every outlet cable shown on the drawings.
  Part#:
  Data Jacks will be 61110-RL6
  Voice Jacks will be 61110-RW6
  Wireless Jacks will be 61110-RY6
  A/V Jacks will be 61110-RG6
  Camera Jacks will be 61110-RP6

2. Category 6 Keystone Jack (for General-Purpose Data/Voice applications)

- Jacks must exceed the Category 6 standard, and must be Component-Rated for performance.
- Jacks shall be 8-position 8-conductor RJ45-style and must have "retention- force technology" or equivalent feature to prevent time damage over the life of the jack regardless of use
- Jacks shall be 8 position un-keyed
- Jack shall be rear-terminated industry- standard 110 IDC. Lead-frame jacks shall not be used in this Cable Plant.
- Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code.
- Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
- Jacks shall terminate 22-26 AWG stranded or solid conductors.
- Jacks shall be compatible with single conductor 110 impact termination tools.
- Jacks shall have an attached color coded wiring instruction label housed between the IDC termination towers.
- Jacks shall be manufactured in the USA
- Jacks shall be compatible with TIA/EIA 606 color code, and have removable high-visibility color labels designating pair locations. Split-colored T568A/B labels are not approved.
- Jacks shall utilize pair-separation towers for ease of untwisting pairs, and shall employ a snap-on rear termination cover designed for suppression and isolate of cross-talk of neighboring connectors.
- Jacks will be terminated according to theT568B wiring scheme.
- Color:
  Data Jacks will be BLUE
  Voice Jacks will be WHITE
  Wireless Jacks will be YELLOW
  A/V Jacks will be GRAY
  Camera Jacks will be PURPLE
- Quantity: Contractor will provide and install one jack for every outlet cable shown on

the drawings.
Part#:

Data Jacks will be 61110-RL6
Voice Jacks will be 61110-RW6
Wireless Jacks will be 61110-RY6
A/V Jacks will be 61110-RG6
Camera Jacks will be 61110-RP6

C. Wall Mount and Modular Furniture Faceplates

1. Wall Plates

- Faceplates shall be UL Listed and CSA Certified
- Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm)
- Faceplates shall provide for TIA/EIA 606 compliant station labeling.
- Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert.
- Faceplates shall have an industry-standard KEYSTONE opening style, and shall accept any Keystone modular insert.
- Faceplates shall be made in the U.S.A.
- Color: Faceplate to be WHITE
- Quantity: Contractor will provide and install one single gang faceplate for each outlet shown on the drawings.
- Part#:

  6 Port Face Plate, PN# 42080-6WS
  4 Port Face Plate, PN# 42080-4WS
  2 Port Face Plate, PN# 42080-2WS

2. Blank Insert

- Color: Blank Insert to match device place or raceway.
- Quantity: Contractor will provide and install one insert for every unused port in a faceplate.
- Part#: 41084-B*B

3. Blank Wall Plates

- Faceplate shall be constructed from stainless steel.
- Faceplates shall be UL Listed and CSA Certified
- Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm) for single gang.
- Color: Faceplate to be STAINLESS STEEL
- Quantity: Contractor will provide and install one faceplate for each unused data/voice/video/intercom outlet shown on the drawings.
- Part#: 84014-40

4. Surface Mount Raceway Insert

Inserts for Wiremold's 4050, 5450 and 5550 Device Mounting Brackets

- Insert shall allow for two category 6 jacks to be mounted flush.
- Insert shall match the color of the Raceway installed.
- Color: Faceplate to be IVORY
- Quantity: Contractor will provide and install one 2-port insert for each outlet in the Surface Mount Raceway shown on the drawings.
- Part#: Equal to Wiremold, PN# 5507-FRJ

2.2 HORIZONTAL DISTRIBUTION CABLING

The horizontal distribution cabling system is the portion of the telecommunications cabling system that extends from the Work Area (WA) telecommunications outlet/connector to the horizontal cross-connect in the Telecommunications Room (TR).

- Cabling Support System
- Copper Station Cabling
- Copper Cross-Connect Cabling

A. Copper Station Cable

1. Category 6A Unshielded Twisted Pair (UTP) Cable

- Cable will meet or exceed the proposed requirements of ANSI/TIA 568-C.2 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, PSANEXT, and Delay Skew.
- Cable shall be proven to support 10 Gigabit Ethernet / 10GBASE-T, Gigabit Ethernet / IEEE 802.3an, Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
- The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
- All cable shall conform to the requirements for communications circuits defined by the California Electrical Code (Article 800) and the Canadian Building Code. Cable listed to CEC Article 800-51(a) will be used for "Plenum" installations. Cable listed to CEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
- Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
- Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
- Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
- Cables shall be made in the U.S.A.
- The listed Category 6A cables in this specification are manufactured by Berk- Tek
- Color:
  Data cable jacket will be BLUE
  Data cable for Security Cameras will be PURPLE
- Quantity: See Drawing for quantity and installation details.
- Part#:
  <u>For Riser Application:</u>
  Berk-Tek LANmark-10G2, PN# 11084689
  <u>For Plenum Application:</u>
  Berk-Tek LANmark-10G2, PN# 11085339
  <u>For Indoor/Outdoor Application:</u>
  Berk-Tek LANmark 10G OSP

2. Category 6 Unshielded Twisted Pair (UTP) Cable

- Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568- C.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
- Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM

up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP- PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.

- The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
- All cable shall conform to the requirements for communications circuits defined by the California Electrical Code (Article 800) and the Canadian Building Code. Cable listed to CEC Article 800-51(a) will be used for "Plenum" installations. Cable listed to CEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
- Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
- Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
- Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
- Cables shall be made in the U.S.A.
- The listed Category 6 cables in this specification are manufactured by Berk- Tek
- Color:
  Data cable jacket will be BLUE
  Data cable for Security Cameras will be PURPLE
- Quantity: See Drawing for quantity and installation details.
- Part#:
  <u>For Riser Application:</u>
  Superior Essex PN# 77-240-2A or Berk-Tek PN# 10136339
  <u>For Plenum Application:</u>
  Superior Essex PN# 77-240-2B or Berk-Tek PN# 10136226
  <u>For Indoor/Outdoor Application:</u>
  Mohawk CDT PN# M58772 (all cable jackets will be BLACK)

B. Horizontal Copper Cross-Connect Cabling

1. Voice Cross-Connect Cabling

- Cable shall meet and/or exceed the UL Listed Type CMR and the ANSI/ICEA S-80-576 standard.
- Cables shall be made in the U.S.A.
- Core Construction
  - Conductors: Solid-copper conductors, 24 AWG.
  - Insulation: Flame retardant semi-rigid PVC.
  - Core Assembly: Cable core will be made up of 100 pair units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders.
- Jacket: Gray, flame retardant PVC jacket.
- Color: Voice cable jacket will be GRAY
- Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs required for the cross-connect by 1.25 to the nearest 25-pair increment.
- Part#:

Superior Essex Cable:	Berk-Tek:
25 pair = PN# 18-475-33	10032396
50 pair = PN# 18-579-33	10032471
100 pair = PN# 18-789-33	10032472

2.3 BACKBONE CABLING

The backbone cabling system is the portion of the telecommunications cabling system that extends from the Intermediate Distribution Frame (IDF) to the Main Distribution Frame (MDF).

- Fiber Optic Backbone Cabling
- Copper Backbone Cabling

A. Fiber Optic Backbone Cabling

1. Data System Backbone Cabling
   - Cable shall be UL/cUL OFNR/OFN FTA rated and be Flame Resistant in accordance with the UL 1666.
   - Cable shall an OSP.
   - Cable shall be constructed utilizing a loose tube design.
   - Cable will be fully water blocked combining overall water blocking tape and a moisture blocking gel for each individual tube.
   - Cable will maintain the following:
     - Crush Resistance (EIA-455-41) = 2000 N/cm
     - Impact Resistance (EIA-455-25) = 2000 Impacts w/1.6 N-m
     - Min Bend Radius:
       Long Term - No Load = 15x Cable diameter Short Term – Load = 20x Cable diameter
     - Operating Temp. = -40°C to +70°C
     - Storage Temp. = -40°C to +80°C
   - Cable shall be constructed of 50/125µ Laser Optimized rated glass capable of:
     1 Gigabit Ethernet Link at 1000m/600m (@850nm/1300nm)
     10 Gigabit Ethernet Link at 300m/300m (@850nm/1300nm)
   - ALL FIBER SHALL BE FUSION SPLICED
   - The Fiber Optic Cable in this specification is manufactured by Berk-Tek
   - Color: Fiber Optic cable jacket will be Black
   - Quantity: See Drawing for quantity and installation details.
   - NOTE: HYBRID CABLES ARE PREFERRED OVER SEPARATE RUNS OF EACH TYPE OF CABLE. PROVIDE JUSTIFICATION IF YOU ARE NOT ABLE TO USE THE HYBRID CABLE.
   - THE CABLES LISTED BELOW ARE ARMORED CABLE. CONTRACTOR IS REPOSNBILE TO VERIFY DIAMETER OF CABLES NEEDED VERSUS AVAILBLE CONDUIT PATHWAY. ARMORED CABLE IS PREFERRED FOR ANY CABLING BETWEEN BULDINGS. IF ARMORED CABLE CANNOT BE USED, CONTRACTOR TO NOTIFY OWNER IN WRITING AT A MIMUMUM OF 30 WORKING DAYS PRIOR TO CABLE INSTALLATION.
   - Field Breakout Kits: Leviton PN# 49887-12S is to be used for all cables more than 6 strands. Six strand cables will use 49887-06S. Provide two kits per buffer tube to be terminated.

     6 Strand Armored Single Mode Fiber (needs two breakout kits)
     Equal to Berk-Tek, PN# OPRK006AB0403
     .
     12 Strand Armored Single Mode Fiber (needs two breakout kits)
     Equal to Berk-Tek, PN# OPRK012AB0403

     24 Strand Armored Single Mode Fiber (needs four breakout kits)
     Equal to Berk-Tek, PN# OPRK12B024AB0403

36 Strand Armored Single Mode Fiber (needs six breakout kits)
Equal to Berk-Tek, PN# OPRK12B036AB0403

48 Strand Armored Single Mode Fiber (needs eight breakout kits)
Equal to Berk-Tek, PN# OPRK12B048AB0403

60 Strand Armored Single Mode Fiber (needs ten breakout kits)
Equal to Berk-Tek, PN# OPRK12B060AB0403

72 Strand Armored Single Mode Fiber (needs twelve breakout kits)
Equal to Berk-Tek, PN# OPRK12B072AB0403

6 Strand Armored Multi Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# OPRK006EB3010/25

12 Strand Armored Multi Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# OPRK012EB3010/25

24 Strand Armored Multi Mode Fiber (needs four breakout kits)
Equal to Berk-Tek PN#OPRK12B024EB3010/25

36 Strand Armored Multi Mode Fiber (needs six breakout kits)
Equal to Berk-Tek PN#OPRK12B036EB3010/25

48 Strand Armored Multi Mode Fiber (needs eight breakout kits)
Equal to Berk-Tek PN#OPRK12B048EB3010/25

60 Strand Armored Multi Mode Fiber (needs ten breakout kits)
Equal to Berk-Tek PN#OPRK12B060EB3010/25

72 Strand Armored Multi Mode Fiber (needs twelve breakout kits)
Equal to Berk-Tek PN#OPRK12B072EB3010/25

Hybrid 6 Armored Strand Multi Mode, 6 Strand Single Mode Fiber
(needs 2 breakout kits)
Equal to Berk-Tek, PN# OPRK012-006EB3010/25-006AB0403

Hybrid 12 Armored Strand Multi Mode, 12 Strand Single Mode Fiber (needs 4 breakout kits)
Equal to Berk-Tek, PN# OPRK12B024-012EB3010/25-012AB0403

Hybrid 18 Armored Strand Multi Mode, 18 Strand Single Mode Fiber (needs 6 breakout kits)
Equal to Berk-Tek, PN# OPRK12B036-018EB3010/25-018AB0403

Hybrid 24 Armored Strand Multi Mode, 24 Strand Single Mode Fiber (needs 8 breakout kits)
Equal to Berk-Tek, PN# OPRK12B048-024EB3010/25-024AB0403

Hybrid 36 Armored Strand Multi Mode, 36 Strand Single Mode Fiber (needs 12 breakout kits)
Equal to Berk-Tek, PN# OPRK12B072-036EB3010/25-036AB0403

Hybrid 48 Armored Strand Multi Mode, 48 Strand Single Mode Fiber (needs 16 breakout kits)

Equal to Berk-Tek, PN# OPRK12B096-048EB3010/25-048AB0403

Hybrid 60 Armored Strand Multi Mode, 60 Strand Single Mode Fiber (needs 20 breakout kits)
Equal to Berk-Tek, PN# OPRK12B120-060EB3010/25-060AB0403

Hybrid 72 Armored Strand Multi Mode, 72 Strand Single Mode Fiber (needs 24 breakout kits)
Equal to Berk-Tek, PN# OPRK12B144-072EB3010/25-072AB0403

NON-ARMORED CABLE – NOTIFY OWNER WITH JUSTIFICATION AS TO WHY THE NON-ARMORED CABLE IS RECOMMEND FOR USE BY CONTRACTOR AT LEAST 30 WORKING DAYS PRIOR TO SCHEDULE INSTALLATION.

6 Strand Single Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# OPR006AB0403
.
12 Strand Single Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# OPR012AB0403

24 Strand Single Mode Fiber (needs four breakout kits)
Equal to Berk-Tek, PN# OPR12B024AB0403

36 Strand Single Mode Fiber (needs six breakout kits)
Equal to Berk-Tek, PN# OPR12B036AB0403

48 Strand Single Mode Fiber (needs eight breakout kits)
Equal to Berk-Tek, PN# OPR12B048AB0403

60 Strand Single Mode Fiber (needs ten breakout kits)
Equal to Berk-Tek, PN# OPR12B060AB0403

72 Strand Single Mode Fiber (needs twelve breakout kits)
Equal to Berk-Tek, PN# OPR12B072AB0403

6 Strand Multi Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# OPR006EB3010/25

12 Strand Multi Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# OPR012EB3010/25

24 Strand Multi Mode Fiber (needs four breakout kits)
Equal to Berk-Tek PN#OPR12B024EB3010/25

36 Strand Multi Mode Fiber (needs six breakout kits)
Equal to Berk-Tek PN#OPR12B036EB3010/25

48 Strand Multi Mode Fiber (needs eight breakout kits)
Equal to Berk-Tek PN#OPR12B048EB3010/25

60 Strand Multi Mode Fiber (needs ten breakout kits)
Equal to Berk-Tek PN#OPR12B060EB3010/25

72 Strand Multi Mode Fiber (needs twelve breakout kits)

Equal to Berk-Tek PN#OPR12B072EB3010/25

Hybrid 6 Strand Multi Mode, 6 Strand Single Mode Fiber (needs 2 breakout kits)
Equal to Berk-Tek, PN# OPR012-006EB3010/25-006AB0707

Hybrid 12 Strand Multi Mode, 12 Strand Single Mode Fiber (needs 4 breakout kits)
Equal to Berk-Tek, PN# OPR024-012EB3010/25-012AB0403

Hybrid 18 Strand Multi Mode, 18 Strand Single Mode Fiber (needs 6 breakout kits)
Equal to Berk-Tek, PN# OPR036-018EB3010/25-018AB0403

Hybrid 24 Strand Multi Mode, 24 Strand Single Mode Fiber (needs 8 breakout kits)
Equal to Berk-Tek, PN# OPR048-024EB3010/25-024AB0403

Hybrid 36 Strand Multi Mode, 36 Strand Single Mode Fiber (needs 12 breakout kits)
Equal to Berk-Tek, PN# OPR12B072-036EB3010/25-036AB0403

Hybrid 48 Strand Multi Mode, 48 Strand Single Mode Fiber (needs 16 breakout kits)
Equal to Berk-Tek, PN# OPR12B096-048EB3010/25-048AB0403

Hybrid 60 Strand Multi Mode, 60 Strand Single Mode Fiber (needs 20 breakout kits)
Equal to Berk-Tek, PN# OPR12B120-060EB3010/25-060AB0403

Hybrid 72 Strand Multi Mode, 72 Strand Single Mode Fiber (needs 24 breakout kits)
Equal to Berk-Tek, PN# OPR12B144-072EB3010/25-072AB0403

B. Copper System Backbone Cabling

1. Voice System Backbone Cabling

- Cable shall meet or exceed those specified in RUS Bulletin 1753F-208 (REA PE-89)
- Cables shall be made in the U.S.A.
- Core Construction
  - Conductors: Solid, annealed copper, 24 AWG unless otherwise noted on design documents.
  - Insulation: Dual insulation consisting of an inner layer of foamed polyolefin skin, colored coded in accordance with industry standards
  - Core Assembly: Cables of 25 pairs and less formed by assembling pairs together in a single group. Cables of more than 25 pairs formed by twisted pairs arranged in groups with each group having a color coded unit binder.
  - Filling Compound: The entire core assembly completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.
  - Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.
  - Sheath Construction
  - Aluminum Shield: Corrosion protected plastic coated, corrugated 0.008"

aluminum tape.

- Jacket: Black, linear low-density polyethylene.
- Color: Voice cable jacket will be BLACK
- Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs serving the individual telephone handsets by 1.25 to the nearest 25-pair increment.
- Part#: Equal to Superior Essex Cable:

  25 pair = PN# 09-097-02
  50 pair = PN# 09-100-02
  100 pair = PN# 09-104-02
  200 pair = PN# 09-108-02

2.4 TELECOMMUNICATION ROOM

The Telecommunication Room (TR) includes those products that terminate horizontal and backbone cabling subsystems and connect then to the network equipment.

- Patch Cords
- Horizontal Cabling Termination Equipment
- Backbone Cabling Termination Equipment
- Cabinets, Racks, and Enclosures
- Cable Support System

A. Patch Cords

1. Copper Patch Cords

1.1 Category 6 and Category 6A Data/Voice TR Patch Cords

- *OWNER PROVIDED*

1.2 Data to Voice TR Patch Cords

- *OWNER PROVIDED*

2. Fiber Patch Cords

2.1 Fiber Optic TR Multimode Patch Cords

- *OWNER PROVIDED*

2.2 Fiber Optic TR Singlemode Patch Cords

- *OWNER PROVIDED*

B. Horizontal Cable Termination Equipment

1. Copper Termination Equipment

1.1 Data Category 6 and 6A Patch Panels

- Panels shall be made of black 16-gauge steel in 24 port configurations.
- Panels shall have optional rear cable support bar for strain relief. Cable support bar shall attach to the rear of the patch panel itself without the use of additional fasteners or screws.

- Panels shall have write-on blocks and port numbers are silk-screened in white.
- Panels shall provide wiring identification & color code and maintain an in-line, paired punch down sequence that does not require the splitting of conductors from individual cable pairs.
- The panel shall accept all QuickPort modules and feature white write-on front labels.
- Panels shall be ANSI/TIA/EIA-568-C.1, C.2 and ISO/IEC 11801 category 6 compliant.
- Panels shall be UL LISTED 1863 and CSA certified.
- Panels shall be made by an ISO 9002 Certified Manufacturer.
- Panels shall be made in the U.S.A.
- Color: Patch Panel shall be BLACK
- Quantity: See Drawing for quantity and installation details. The number of patch panels to be supplied shall be derived by multiplying the number of data/voice cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 24 port increment.
- Part#:

  24-port Category 6 patch panel, angled recessed, 4W256-H24

  INSTALLATION NOTE: When installing the 24-port patch panel, install two together and provide 1U of rack space for equipment installation then two panels, 1U of space, etc. VERIFY WITH OWNER RACK/CABINET LAYOUT PRIOR TO INSTALLATION.

1.2 Voice Termination Block (Intercom Backbone and Intercom Devices)

- Pair Capacity 50
- Blocks shall be wall mounted.
- Terminates 22 - 26 AWG (0.81 - 0.41mm) solid insulated cable or 18 - 19 AWG (1.02 - 0.91mm) solid stripped cable
- Blocks shall have stand-off legs included for all locations; S89 series stand- off bracket
- Made from High impact flame retardant thermoplastic
- Height: 254mm (10 in.), width: 86.4mm (3.4 in.), depth: 30.5mm (1.2 in.)
- Part#: Leviton or equal
  Termination block, 40066-M50
  Mounting bracket, 40089-00D

C. Backbone Cable Termination Equipment

1. Connectors

1.1 Fiber Optic Connectors

- *Anaerobic & Mechanical terminations will not be accepted.*

1.2 Fusion-Fiber Pigtail Fusion Splice Module

- Integrated module adapter bulkhead for 12 or 24 fibers with self-contained splice holders
- Individual compartments provide slack storage and bend radius guides for respective backbone cable, 900µm tight buffer pigtails, and fusion spliced fibers
- 12-fiber color-coded 900µm tight buffer pigtails 1.5m length are pre-loaded in module per specific configuration
- Modular design allows for ease of maintenance of individual spliced fiber and allows for scaling up without impacting existing fibers
- Included accessory kit consists of heat shrink style splice sleeves, tie wraps, and

mesh sleeve
- Installs in Leviton's Opt-X rack mount (Ultra, 1000i, and 500i) and wall mount fiber enclosures
- Zirconia ceramic ferrules and sleeves used
- 12-fiber splice module configurations will utilize duplex LC adapters
- 24-fiber splice module configurations will utilize quad LC adapters
- ALL FIBER SHALL BE FUSION SPLICED
- Quantity: See Drawing for quantity and installation details.
- Part #: Leviton or equal
- 12-strand Singlemode, SPLCS-12L
- 24-strand Singlemode, SPLCS-24L
- 12-strand Singlemode Fusion Splice pigtail kit, UPPLC-KIT

2. Fiber Termination Panels

2.1 IDF Rack Mount Fiber Panel

- Fiber panels shall be constructed of durable polycarbonate plastic and black powder-coated 16-gauge steel
- Panel shall have a sliding tray which removes completely from enclosure to facilitate field terminations and splicing
- Sliding tray with front and rear stop shall glide forward and backward providing accessibility to front and rear of bulkhead after installation
- Panel shall have a 17" depth for high-density fiber termination and/or splicing
- Front saddles shall pivot for improved patch cord routing and organization
- Removable transparent hinged doors and slide-away covers shall allow for easy access during install and visibility of interior after install
- Panel shall employ patch cord bend radius guides to minimize macro bending
- Stackable and adjustable fiber rings simplify cable management
- Panel shall be no more than 1 rack unit in height and shall hold up to 3 adapter plates.
- Panel shall be Made in the U.S.A
- ALL FIBER SHALL BE FUSION SPLICED
- COLOR: black with translucent blue cover panels
- Quantity: See Drawing for quantity and installation details.
- Part#: Leviton Opt-X SDZ 2000i no exceptions
  1U - 5R1UH-S03

2.2 IDF Wall Mount Fiber Enlosure

- Panels shall be constructed of cold rolled 16 gauge steel with a black powder paint finish and provide for fully enclosed fiber termination.
- Panel shall have a door design. One door shall be lockable for the "technician side" that secures the incoming and outgoing fiber cables. The second door shall accessible to provide fiber patching as needed.
- Panels shall accept four adapter panels for 24 port configurations.
- Panels shall have a splice tray mounting stud incorporated into the base for mounting of mechanical or fusion splice trays. Panel shall have cable management anchor points and come with cable anchors allowing for the maintenance of the incoming cable with the proper minimum bend radius.
- Panels shall have cable entrance ports on the top and bottom with removable plastic dust covers.
- ALL FIBER SHALL BE FUSION SPLICED

- Color: Fiber Panel will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Part: 5W320-00N

2.3 MDF Rack Mount Fiber Panel

- Fiber panels shall be constructed of durable polycarbonate plastic and black powder-coated 16-gauge steel
- Panel shall have a sliding tray which removes completely from enclosure to facilitate field terminations and splicing
- Sliding tray with front and rear stop shall glide forward and backward providing accessibility to front and rear of bulkhead after installation
- Panel shall have a 17" depth for high-density fiber termination and/or splicing
- Front saddles shall pivot for improved patch cord routing and organization
- Removable transparent hinged doors and slide-away covers shall allow for easy access during install and visibility of interior after install
- Panel shall employ patch cord bend radius guides to minimize macro bending
- Stackable and adjustable fiber rings simplify cable management
- Panel shall be 2 or 4 rack units in height and shall hold up to 6 or 12 adapter plates, respectively
- Panel shall be Made in the United States
- ALL FIBER SHALL BE FUSION SPLICED
- COLOR: black with translucent blue cover panels
- Quantity: See Drawing for quantity and installation details.
- Part#: Leviton Opt-X SDX 2000i no exceptions
  2U - 5R2UH-S06
  4U - 5R4UH-S12

2.4 Premise Splice Enclosures – Portable Classroom Distribution

- Modular wall-mount enclosures used to directly splice outside plant or intra-building cables
- Four fusion/mechanical splice trays; 4" Standard Splice Tray, 4" x 11.75" x 0.25" # T4LHS-P06
- Constructed of cold-rolled steel
- ALL FIBER SHALL BE FUSION SPLICED
- CPS-24, Customer Premise Splice Enclosure, empty (2 tray capacity)
- Part#: CPS24-STD

2.5 Fiber Optic Adapter Plates

- The Fiber adapter plate shall precision molded and compatible with all approved panels and enclosures (rack- or wall-mount).
- The adapter plate shall be offered in LC style in 12 or 24 fiber configurations per plate.
- The adapter plate shall be compliant to TIA-568-C.3 (for performance) and respective TIA-604-X (for intermateability) standards.
- Adapter plates shall use zirconia ceramic sleeves and be offered in standard fiber type colors pursuant to TIA-568-C.3 standards.
- The adapter and plate shall be integrated using precision-molded injection manufacturing methods, to eliminate “rattle” and loose fit.
- Adapter plates shall be made in the United States of America.
- Meets TIA-604-10B (LC) for connector intermateability

- ALL FIBER SHALL BE FUSION SPLICED
- COLOR: Aqua for Multimode, Blue for Singlemode, Black for blank plates
- Part #:
  6-port Duplex LC MM Adapter Panel, 5F100-2QL
  6-port Duplex LC SM Adapter Panel, 5F100-2LL
  Blank Adapter Panel, 5F100-PLT

2.6 Fiber Optic OSP Splice Enclosures

- Used to directly splice outside plant or intra-building cables.
- Accommodates various splice tray designs, Maximum Capacity: 96 single fibers using 5" x 7" and 4" x 7" trays
- Enclosure mode from 16-gauge steel, Hinges shall be Stainless steel
- Two-year limited product warranty.
- Durable powder-coat finish COLOR: Beige
- Size 16" x 15" x 3.4"
- ALL FIBER SHALL BE FUSION SPLICED
- Part #:
  Leviton CPS Customer Premise Splice Enclosure, Single Door, 24 Fiber Trays # CPS24-STD
  Injection Molded Mini Splice Tray, Heat Shrink style (accepts standard sleeves), up to 12 fiber splicing # T5PLS-12F
  Splice Tray Mounting Hardware Kit # SPLMT-HKT
  Splice Sleeve, 40 mm # FSSSD-040
  Cable clamp kit # CPCSR-001 & CPCSR-002
  Grounding kit # CPGRD-KIT
  Key Locking kit # CPLOK-KIT

3. Copper Termination Panels

3.1 OSP Protection Panels (Intercom Backbone Headend)

- 16 AWG Powder Coated Steel Construction
- Equipped with an Internal 26 AWG Fuse Link
- External Ground Connectors Accept 6 - 14 AWG Wire
- Industry Standard 5 Pin Design
- Exceeds UL497 Primary Protection Standards
- Stackable with Connection Grommets Included
- 66 Block Accepts 22 - 26 AWG Wire/18 - 19 AWG Stripped Solid Copper Wire
- Color: NA
- Quantity: See Drawing for quantity and installation details.
  Part#: Circa Enterprise inc.
  25 pair block, PN#1890ECT125
  50 pair block, PN# 1890ECT1-50
  100 pair block, PN# 1890ECT1-100

3.2 OSP Protection Fuses

- 240VDC (RUS Approved)
- Nanosecond response time
- External failsafe mechanism that permanently carbon arrestors grounds the module under sustained high current conditions
- Integrated Test Points

- UL & cUL listed
- Designed to meet or exceed Telcordia standards
- ISO 9002 Certified Manufacturer
- Color: RED
- Quantity: See Drawing for quantity and installation details.
  Part#: Circa Enterprise inc. 4B1SF-240
  **Provide 100% fuse density for all installed Protection Panels.*

3.3 Voice Termination Block (Intercom Backbone building/TC and Intercom Devices)

- Pair Capacity 50
- Blocks shall be wall mounted.
- Terminates 22 - 26 AWG (0.81 - 0.41mm) solid insulated cable or 18 - 19 AWG (1.02 - 0.91mm) solid stripped cable
- Blocks shall have stand-off legs included for all locations; S89 series stand- off bracket
- Made from High impact flame retardant thermoplastic
- Height: 254mm (10 in.), width: 86.4mm (3.4 in.), depth: 30.5mm (1.2 in.)
- Part#:
  Leviton 66-Style Termination block, 40066-M50
  Leviton 66-Style Mounting bracket, 40089-00D

D. Cabinets, Racks, and Enclosures

Contractor will provide the following 'HC' Enclosures and components based on the number of cables to that will be terminated:

1. Cabinets:

- Wall-mounted cabinets shall be manufactured from steel sheet.
- Each cabinet will have a rear panel that attaches to the wall, a hinged cabinet body that swings open from the rear panel providing easy access to the rear of equipment and a locking front door.
- The rear panel will provide cable access with pre-punched knockouts, up to 3", for conduit along the top and bottom edges of the panel. There will also be cutouts in the back of the rear panel so that cables can enter the panel through the wall. The rear panel will provide attachment points for accessory equipment mounting brackets and cable tie points within the panel (cabinet).
- The cabinet body will include a single pair of vertical 19" EIA equipment mounting rails. The mounting rails will be EIA-310-D compliant with the Universal hole pattern. Mounting holes will have #12-24 threads.
- Mounting rails will be adjustable in depth so that they can be positioned at any point within the cabinet body. The design of all cabinets will allow an additional pair of mounting rails (for a total of two pairs of mounting rails per cabinet) to be added to the cabinet.
- The wall-mount cabinet shall provide a hinge design that attaches the cabinet body and the rear panel and allow the rear panel to be removed during installation. The hinge design will allow the cabinet body to open at least 90°. The hasp used to secure the rear panel and the cabinet body together will assist in drawing the components together during the locking action.
- The cabinet body will include vents that are designed to accept fan kits.
- The front door will be hinged and locking. The front door and rear panel will be keyed alike. The front door will have rounded edges and corners. The cabinet body will allow the front door to be attached so that it will swing open from the right or left. The cabinet

manufacture shall provide an option for a solid or a tinted plexi-glass window front door. The plexi-glass in doors shall be bronze acrylic (not clear) with a UL flammability classification of 94HB or better.

- Finish shall be epoxy-polyester hybrid powder coat (paint).
- The cabinet shall have the option of being delivered fully assembled. All cabinets will include installation hardware (hex lag screws) for wood studs and 50 each #12-24 equipment mounting screws.
- Load bearing capacity for cabinets that wall-mount will be a minimum of 200 pounds per cabinet.
- Cabinets that are wall-mount only will be certified and UL Listed to standard UL 60950 under category NWIN.
- CONTRACTOR TO INSTALL PROFESSIONALY SO OWNER PROVIDED EQUIPMENT FITS IN THE RACK. VERIFY RAILS ARE PROPERLY ALIGNED SO ALL EQUIPMENT FITS (including UPS, Network equipment, cables, cords, power strip, etc.) AND DOORS CLOSE. VERIFY SPACING BETWEEN PANELS IS ADEQUATE FOR EQUIPMENT INSTALLATION. VERIFY WITH OWNER CABINET LAYOUT FOR PATCH PANELS, ETC BEFORE INSTALLATION.
- Color: Wall Mount Cabinet will be BLACK
- Quantity: See Drawing for size, quantity and installation details.
- Part#:

  Wall Mount Cabinet
  18U Cabinet equal to Chatsworth Products, PN# 11900-736 26U
  Cabinet equal to Chatsworth Products, PN# 11900-748
  **Contractor will provide an additional set of mounting rails for each wall mount cabinet, equal to Chatsworth Products PN# 12787-5xx.*
  Wall/Floor Mount Cabinet
  33U Cabinet equal to Chatsworth Products, PN# 13495-760 40U
  Cabinet equal to Chatsworth Products, PN# 13495-772
  **Contractor will provide an additional set of mounting rails for each wall mount cabinet, equal to Chatsworth Products PN# 13276-7xx.*
  Fan Kit/Filter Kit
  Equal to Chatsworth Products Fan Kit, PN# 12804-701
  Equal to Chatsworth Products Filter Kit, PN# 12805-701

  Grounding Kit
  Equal to Chatsworth Products, PN# 10610-019
  Power Strip with Surge Suppression
  Leviton 5500-192

2. Floor Mount 2-post Racks

- Each rack shall have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack shall assemble with nut and bolt hardware. The base angles shall be pre-punched for attachment to the floor.
- Equipment mounting channels shall be 3" (76 mm) deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern, 1-3/4" (44.45 mm) rack-mount spaces (U), to provide 45U, 52U or 58U for equipment. Each mounting space (U) shall be marked and numbered on the mounting channel.
- When assembled with top and bottom angles, equipment-mounting channels shall be spaced to allow attachment of 19" EIA rack-mount equipment. Equipment attachment points shall be threaded with 12-24 roll-formed threads. The rack shall include assembly and equipment-mounting hardware. Racks shall include 50 each combination pan head, pilot point mounting screws.
- The assembled rack shall measure 7' (2.1 m)/84" (2133 mm) high, 8' (2.4 m)/96" (2438 mm) high or 9' (2.7 m)/108" (2743 mm) high; 20.3" (515.9 mm) wide and 15" (381.0 mm) deep. The sides (webs) of the equipment-mounting channels shall be punched to

allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

- Assembly hardware shall electrically bond the top angles, side channels and base angles together when assembled, and there shall be a masked ground attachment point with 1/4-20 threaded studs spaced 5/8" apart on the inside of the side channel to attach a ground lug allowing easy attachment to the Telecommunications Ground.
- The rack shall be rated for 1,000 lb (453.6 kg) of equipment.
- Certifications: Communications Circuit Accessory, DUXR and DUXR7 category, file number 140851
- Material: Steel and aluminum extrusion
- Construction: Bolted assembly, Ships unassembled
- VERIFY RACK LAYOUT WITH OWNER PRIOR TO INSTALLATION.
- Color: BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Chatsworth Products Inc.

  Floor Mount 2-Post Rack
  CPI# 55053-703
  Vertical Wire Managers
  Equal to Leviton, PN# 8980L-VFR
  Power Strip with Surge Suppression
  Leviton 5500-192

3. Floor Mount 4-post Racks

- Four-post frame with threaded mounting holes used to support 19" wide rack- mount communications equipment and shelves
- For indoor use only, in environmentally controlled areas; may not be used
- outdoors, in industrial or harsh environments, or in plenum spaces
- Includes: (1) top pan, (1) bottom pan, (4) mounting channels, (2) base angles, (2) top angles
- Assembly hardware; (100) #12-24 equipment mounting screws
- Equipment Support: Front and rear pairs of 3" deep C-shaped equipment mounting channels, Fixed in place, 29" apart front-to-rear, 19" wide, EIA-310- D compliant hole pattern
- 1-3/4" high rack-mount units (RMU); RMU spaces are marked and numbered on the channels
- Universal hole pattern, 5/8"-5/8"-1/2" vertical hole spacing
- Threaded #12-24 equipment mounting holes, Includes 100 each #12-24 equipment mounting screws
- Load capacity: 2000 lb of equipment
- Material:; Aluminum extrusion, Aluminum sheet
- Construction: Bolted assembly, Ships unassembled
- VERIFY WITH OWNER RACK LAYOUT PRIOR TO INSTALLATION.
- Color: BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Chatsworth Products Inc.

  Floor Mount 4-Post Open Frame Rack
  CPI# 15053-703
  Grounding Kit 10610-019
  Power Strip with Surge Suppression
  Leviton 5500-192

4. Floor Mount Cabinets

- Four-post frame with threaded mounting holes used to support 19" wide rack- mount communications equipment and shelves
- For indoor use only, in environmentally controlled areas; may not be used
- outdoors, in industrial or harsh environments, or in plenum spaces
- Includes: (1) top pan, (1) bottom pan, (4) mounting channels, (2) base angles, (2) top angles
- Assembly hardware; (100) #12-24 equipment mounting screws
- Equipment Support: Front and rear pairs of 3" deep C-shaped equipment mounting channels, Fixed in place, 29" apart front-to-rear, 19" wide, EIA-310- D compliant hole pattern
- 1-3/4" high rack-mount units (RMU); RMU spaces are marked and numbered on the channels
- Universal hole pattern, 5/8"-5/8"-1/2" vertical hole spacing
- Threaded #12-24 equipment mounting holes, Includes 100 each #12-24 equipment mounting screws
- Load capacity: 2000 lb of equipment
- Material:; Aluminum extrusion, Aluminum sheet
- Construction: Bolted assembly, Ships unassembled
- VERIFY WITH OWNER CABINET LAYOUT PRIOR TO INSTALLATION.
- Color: BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Chatsworth Products Inc.
  Floor Mount Cabinet
  CPI# M1050-741
  Grounding Kit 10610-019
  Power Strip with Surge Suppression
  Leviton 5500-192

5. Outdoor Wireless Access Point Enclosure

- Non-glass-filled polyester material, UV resistance; Overlapping tongue-and-groove raised cover and gasket provide secure Type 4X seal
- Removable snap-hinge cover allows for easy access to cover and body for modifications
- Molded layout grid on inside of body and solid covers assists with component mounting
- Molded-in embosses for rear panel mounting
- Internal rail system and adjustable panel blocks allow
- UL 508A Listed, NEMA/EEMAC Type 4
- Material: Non-glass-filled polyester
- Color: Light-Gray
- Quantity: See Drawing for quantity and installation details.
- Part#: Pentair
- Polypro Wifi, PN# D16148WF

E. Cable Support System

1. Ladder Rack Cable Runway

- Stringers shall be fabricated from 16ga .375" x 1.5" Cold Rolled Steel tubing.
- Rungs shall be fabricated from 16ga .5" x 1.0" Cold Rolled Steel tubing
- Rungs shall be spaced at 9.0" center to center
- A straight length of ladder shall be capable of supporting 45 pounds per foot when a 10'

length is tested according to NEMA VE-1.
- Ladder Rack shall have a powder coat finished.
- Ladder Rack shall be available in standard 6ft. and 10ft. lengths.
- Ladder rack shall be a part of a total system that includes: manufacture bends, wall supports, joining hardware, etc.
- Ladder Rack shall be grounding per the TIA/EIA 607-A.
- Color: Ladder Rack will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Equal to Chatsworth Products Cable Raceway, PN# 11252-71X

PART 3 – BACKBONE SLACK LOOPS

- Storage rings may be used to store coiled slack loops on backboard.
- Part #:
  Fiber storage rings, Indoor fiber: 48900-IFR
  Fiber storage rings, Outdoor fiber: 48900-OFR

PART 4 – EXECUTION

4.1 INSTALLATION

A. Work Area Outlets Installation

- No more than 12” of cable shall be stored in an outlet box, modular furniture raceway, or insulated walls.
- Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
- The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
- All UTP cables shall have no more than 6.4mm (1/4 inch) of pair *untwisted* at the termination point.
- Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).
- Voice jacks, unless otherwise noted in drawings, shall occupy the next position(s) below the data on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the position left of the data jack.
- Video jacks, unless otherwise noted in drawings, shall occupy the bottom position(s) on the faceplate. Video jacks in horizontally oriented faceplates shall occupy the position left of the data/voice jack.
- All faceplates installed shall be level.
- All outlets will be labeled according to the approved labeling scheme.
- Each faceplate shall be machine labeled. The labeling shall be placed on the faceplate so that the individual jack can be clearly identified by its associated label.
- Cables shall be identified by a self-adhesive label in accordance with the Identification and Labeling section of this specification and ANSI/TIA/EIA- 606. The cable label shall be applied to the cable no further than 6” behind termination module, behind the faceplate on a section of cable that can be accessed by removing the cover plate.

B. Horizontal Distribution Cable Installation

- Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.

- Nylon or plastic locking cable ties, e.g. "Zip-Ties", shall not be used on this project.
- Contractor will provide at least a three foot “service loop” for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- Tie Wraps will not be allowed for supporting, bundling and/or dressing of any station cables on this project.
- Contractor will provide at least a three foot “service loop” for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in all “common” conduit runs. “Common” Conduit Runs are those that house more than one cable or set of cables that do not specifically feed a Work Station Outlet. Examples of “Common” Conduit Runs are: floor/ceiling penetrations, stub-throughs, distribution conduits, all conduits between J- boxes, etc.
- Cable raceways shall not be filled greater than the Owner’s 40% fill ratio. Contact Owner as needed to understand the Owner’s fill ratio requirement.
- Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
- Pulling tension on 4-pair UTP cables shall not exceed 25-lb for a four-pair UTP cable.
- The Cable Support System shall be installed in such a way that will allow for future cables to be added and to provide sufficient protection of all cable.
- For all installs where station cables are not installed in a continuous conduit run the following guidelines will apply. The Contractor will be responsible to reinstall all cables and pathways that do not meet with the following at no additional cost to the Owner:
  - J-hooks shall be installed to support all station cables every 14” – 28” inches.
  - All pathways shall be run at right angles. No diagonal pathways will be allowed unless otherwise noted on the drawings.
  - Horizontal cables shall be bundled in groups of no more than 25 cables per Caddy’s CAT21 J-hook, no more than 40 cables per Caddy’s CAT32 J-hook, and no more than 64 cables per Caddy’s CAT64 J-hook.
  - A separate J-hook is used for each group of cable. Specifically, CAT6 cable, fiber cable, and fire alarm are to have their own J-hook.
  - At no point shall cable(s) rest on acoustic ceiling grids, acoustic panels, or lighting fixtures.
  - All cables will be installed so that there is a minimum of 3” of clearance above all ceiling grid and tiles.
  - All cables will be installed so that there is a minimum of 12” of clearance above all florescent lighting.
  - All cables will be installed so that there is a minimum of 6” of clearance from all fire alarm and electrical system conduits.
  - Cables shall not be attached to the ceiling grid or lighting fixture wires. The contractor will provide their own carriers wires to support their horizontal cabling.
  - All cables shall be installed above fire-sprinkler systems and plumbing system fixtures and devises. Cables shall not be attached to or supported by these fixtures and/or their ancillary equipment or hardware.
  - The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
  - Contractor is responsible for sealing around all cables that penetrate fire rated barriers.
  - Wireless and overhead cables shall be secured by an in-ceiling mounting bracket affixed to its dedicated ceiling wire or mounted to building structure.
- Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

C. Horizontal Cross-Connect Installation

- Cables shall be cleaned, dressed, and terminated in accordance with the recommendations made in

the TIA/EIA-568-A standard, manufacturer's recommendations and best industry practices. Contractor to verify standard network equipment can be installed without any interference from the cables. Equipment typically is installed directly above and/or below the panel.

- The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
- All UTP cables shall have no more than 6.4mm 1/4 inch) of pair *untwist* at the termination point.
- Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- All cables shall be neatly bundled in groups of 24 and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. Contractor will use Velcro strip to bundle cables together. The use of Tie –Wraps is not permitted.
- Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

D. Backbone Cable Installation

- Backbone cables shall be installed separately from horizontal distribution cables.
- Each individual cable is to be labeled. See details sheets for labeling examples. Cable type, installation date, and from/to are required. Each cable to be labeled at any accessible point, including, but not limited to, pull boxes, Christy boxes, junction boxes, and any pass through location.
- Where possible the backbone and horizontal cables shall be installed in separate conduits.
- Where possible backbone cables of the same type shall be combined in conduit runs to maximize conduit fill ratios.
- Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- Pulling tension on Backbone cables shall not exceed the manufacture's limitations.
- The minimum bend radius for all Backbone cables is 16 times the cable diameter or the manufactures specification, whichever is greater.
- Cable slack shall be provided in every pull box, junction box, cabinet, entry facility, telecom room and termination enclosure.
  * 25 feet of slack per cable shall be mounted on a service ring inside the enclosure.
  * All cable shall be installed such that all cable is above the bottom of the enclosure. All cable shall be suspended on cable support hooks around the perimeter of the enclosure. Cable Support Hooks equal to Hubbell Power Systems PN# C2031124 and C2031133 (part numbers dependent on size of enclosure, sample part numbers only, not to be used in all circumstances).
  * Entry & telecom rooms & cabinets: Minimum 25' feet coiled in re- closeable storage ring.
  * If 25' is not possible, contact the owner and discuss an agreeable amount of slack, followed up with an confirming RFI.
  * Minimum of 25' of slack in each vault and a minimum of 15' of slack in any other type of box (pull box, Christy box, pass through space, etc).
- All OSP cables may not penetrate more than 50ft into the buildings before be terminated or splices to cable with a fire resistant jacket, unless the jacket is indoor/outdoor rated.
- A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

E. Backbone Cross-Connect Installation

- Cables shall be cleaned, dressed, and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and best industry practices.
- Bend radius of the cable in the termination area shall not exceed 16 times the outside diameter of the cable.
- All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks.
- Contractor will provide a minimum of a 3 foot “service loop” for each backbone cable before terminating to allow future rearrangement. Cables will be coiled and secured above the ceiling where possible or to the Telco Backboard where entrance point is from the floor.
- Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18” from the finished floor.
- Contractor shall provide a machine label 1ft. to 2ft. from the entrance point of the TR and 6in. to 12in. from the termination point on each backbone cable. Cable shall be easily identified and fully legible without removing the bundle support ties.

F. Cabinets, Racks, Enclosures and Ladder Rack Installation

- Wall Mount Racks/Cabinets shall be securely attached to the Telco Backboard using minimum 5/16” hardware or as required by local codes. Mounting rails shall be adjusted to the proper depth to allow for the closing of doors when populated with network electronics. Coordinate with Owner for final depth required.
- Floor Mount Racks/Cabinets shall be securely attached to the concrete floor using minimum 3/8” drop-in anchor hardware or as required by local codes.
- All Floor Mount Racks/Cabinets will be either; secured on one side to the wall or attached to the closest wall with ladder rack.
- All Racks/Cabinets shall be braced to meet Zone 4 seismic requirements.
- Contractor will maintain a minimum of 36 inches of clearance from the front of the all rack/cabinets and all other obstructions.
- Floor Mount Racks/Cabinets shall be installed to allow for a minimum of 36” from rear and all other obstructions.
- All racks shall be grounded to the telecommunications ground bus bar.
- Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- The plywood bottom edge shall be mounted vertically no less than 12” above the finished floor.
- Contractor will provide all cutouts for the Electrical Contractors expansion rings and electric receptacles as shown on the drawings.
- Ladder Rack must be securely attached to walls, backboards, and racks/cabinets to comply with all Zone 4 seismic requirements.
- Ladder rack shall be installed so that there is a minimum of 8” of unobstructed clearance above rack.
- Ladder Rack shall be installed so that there is a minimum of 12” of clearance from all: florescent lighting, electrical conduits/circuits, and fire alarm conduits/devices.

4.2 IDENTIFICATION AND LABELING

A. The labeling scheme for CAT6 cable is as follows for classrooms (verify with Owner prior to printing the labels):

When entering the room (if the room has multiple doors, the door designated as the primary entry

door), label numbering shall start a one (1) and then increment as data drops are added going around the room, then any drops in the ceiling, and then any drops in the floor. For each room, numbering starts over at one (1). Each jack color starts at one (1) and increments for each additional jack of the same color. Label designations are based on jack color:

Blue = D# White = V# Yellow = W# Gray = A# Purple = C#

Patch Panel Label Format: RM# - __

The first part of the label shall be the room number the data drop is located in, RM is part of the label, followed by the room number or room designation. The last part of the label shall be the type, as stated above based on jack color, then followed by the drop number. For example, RM3-D10 is room 3, data drop 10. RM3-V2 would be room 3, voice data drop 2.

The label format in the room: RM# - -

The first part of the label shall be RM, followed by the room number/ designation the cabinet/rack is located in.

The second part of the label shall be the patch panel the cable is terminated on. The top most panel is A and continues down with B, C, etc… If multiple panels span more than one rack/cabinet, when standing in front of the rack/cabinets, the top left panel shall be A.

The last part of the label uses the label based on jack color, as stated above, and the drop number. Example, RM3-A-D10: Indicates the other end of the cable is in the cabinet/rack in room 3, terminated on panel A, and the last portion, ie D10 in this example, was the tenth data drop in this room. The last portion, D10 in this example, would match the patch panel label, RM3-D10.

Label scheme for non-classroom buildings follows the above scheme, but the label number starts at 1 (one) for each type (D, V, W, A, C) and increments throughout the building and does not reset for each room/office. Start at one and do not repeat the number anywhere in the building (for each type).

B. The approved system will comply with the TIA/EIA -606-A Class 2 designations and include at a minimum, identifiers for all major components of the system: telecommunication rooms, grounding bus bars, racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.

C. All label printing will be machine generated or hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

D. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

E. All fiber cable labels are to include the type, count, from and to on each label. Any point the fiber is accessible shall be labeled. At a minimum, that would include the starting point, any Christy boxes, cabinets/racks, any rooms the cable passes through, and the ending point. Service loops provided and labeled at each location, a minimum of 25’ in each vault and 15’ minimum in a Christy box/any other box or pass through space.

F. Labels are to be verified by Owner prior to printing. Labels are to include building/room designations used by the site. Do NOT use building/room designations from the plans unless approved by Owner in writing.

G. Fiber optic cable lables are to verified by Owner prior to printing and include:

CABLE TYPE
FROM TO
DATE INSTALLED

For example:
Single Mode – 36 Count
MDF IDF in Room XX
INSTALLED: JULY 2017

4.3 TESTING AND ACCEPTANCE

A. General

1. The Owner reserves the right to be present during any & all types of tests being performed.

2. Contractor will notify the Owner/Owner's Representative 24 hours before commencement of testing.

3. Upon receipt of the test documentation, the Customer reserves the right to have the contractor perform a 10% witnessed "spot testing" of the cabling system to validate test results provided in the test document, at no additional cost. If a significant amount of cables are marginal and/or fail during the "spot test" Contractor will retest the entire cable plant at no additional cost.

4. Contractors shall provide proof of test equipment calibration prior to testing.

5. Test equipment shall have been factory calibrated within six months of project testing dates.

6. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of TIA/EIA-568-C, TSB-67 and TSB-95. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

7. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Manufacturer's Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

8. Test results are required to be sent to Owner in PDF format and in FLW format. IF there are an unusual amount of cables that passed marginal, as indicated by the tester, Contractor to re-terminate all cables and re-test.

B. Copper Cable Testing

1. Twisted Pair Cable

- All twisted-pair copper cable links (including backbone cables) shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below.
- Continuity - Each pair of each installed cable shall be tested using a test unit that shows

opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

- Cables that are passed by the tester but marked as marginally passed, typically indicated by an asterisk (*), may be required to be re-terminated and re-tested by Owner if there are an unusually high percentage of cables that were marginally passed by the tester. Unusually high is determined by Owner.
- Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-A Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

2. Category 6 Performance

- Follow the Standards requirements established in:
  - ANSI/TIA/EIA-568-C.0
    Wire Map Length Attenuation
    NEXT (Near end crosstalk)
  - ANSI/TIA/EIA-568-C.2 Return Loss
    ELFEXT Loss Propagation Delay Delay skew
    PSNEXT (Power sum near-end crosstalk loss)
    PSELFEXT (Power sum equal level far-end crosstalk loss)
- A Level III or better test unit is required to verify category 6 performances and must be updated to include the requirements of TSB-95 and Amendment 5. Testers will be equal to or better than Fluke Network's Versiv DSX CableAnalyzer.
- All testers shall have been recalibrated within 6 months of use on this project. Contractor will be asked to provide proof of recalibration.
- Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The approved Level Three tester shall provide a printed document for each test that is also available in a downloadable file using an application from the test equipment manufacturer. The printed test results shall include a print out of all tests performed, and the individual test results for each cable. A PDF of the test results and the Fluke FLW File are required to be sent to Owner for review.

3. Category 6A Performance

- Shall met all test parameters as stated above for Category 6, with the addition of PSANEXT, PSAACR, and PSAACR-F:

C. Fiber Optic Cable Testing

1. Backbone Fiber

- Each fiber strand shall be tested for attenuation with an Optical Power Meter and light source and with an Optical Time Domain Reflectometer (OTDR) for actual length and splice/connector loss. Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
- All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF. The results of OTDR testing to define the length of each riser cable shall be

documented. The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM, A to B, B to A, and OSPL (OSPL is defined as La + Lb). No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss. Tests shall be conducted using ANSI/EIA/TIA/EIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA/EIA-568-C.2.The Contractor shall provide an electronic printout for each strand tested with the Power Meter and the OTDR.

- Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
- All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps necessary to repair or replace any optic not meeting the standard.
- Fiber optic riser and station cable test results shall be provided in electronic format to the Owner. PDF and Fluke FLV files are to be sent to Owner.

4.4 SYSTEM CLOSEOUT AND AS-BUILT DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

D. Test Results documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on USB within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

E. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.

F. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

G. The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

H. Contractor will provide one laminated 11”x17” drawing at each IDF that includes the building layout for that IDF, along with the outlet locations and all of the approved labeling. The as-built/current layout is to be provided.

I. Test results are to be submitted to the manufacturer and a copy of the warranty certification is to be provided to the owner.

END OF SECTION

SECTION 27 70 00 - INTERCOM/CLOCK/PUBLIC ADDRESS SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes a fully operational school internal communications and clock incorporating safety including but not limited to the following:

1. The system shall provide complete internal communications and clock control employing state of the art VoIP Technology including the minimum functions listed.

    a. Two-way Loud Speaking Internal Intercommunications.
    b. Event announcement
    c. Emergency announcement that will override any pre-programmed zones assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
    d. Capability of prerecording emergency announcements that can simply be activated by a simple Soft Key or via a dedicated call-switch.
    e. School Safety Paging and Evacuation tones,
    f. Distributed (MDF/IDF) Electronic Architecture. (No home run wiring for each circuit).
    g. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone,
    h. Paging and Program Distribution.
    i. Incorporate district-wide announcements, either live or recorded thru a direct connection to the WAN and telephone system.

2. Synchronous analog clock and time control

    a. Class change signaling
    b. Atomic Clock Synchronization

3. Emergency call-ins shall take precedence over normal calls so that they are answered first. The system shall support a minimum of 16 call level priorities which shall be user definable.
4. Any authorized administrator shall be able to call from outside the school into any classroom, zone or entire school directly via the School District supplied Telephone Network. This shall allow remote monitoring and two-way conversation from outside the school building as well as Paging into the system. This feature shall allow the user access to all functions via a user defined PIN code. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools)
5. Authorized system users shall be able to record a minimum of ten (10) automated messages with emergency instructions and replay them. Automated message strings shall be either automatically distributed as part of a dial string, manually played from a single-button access on the phone or thru the master clock as a timed event.
6. Paging and two-way loudspeaking features shall be accessible from any telephone by authorized users with the use of a user defined PIN code.
7. The system shall allow users to exclude their classroom from paging and tones in the event of testing or other activity that shouldn't be interrupted. This exclusion will not affect emergency paging. This "exclusion" must have the ability to "reset" at midnight.
8. The system shall synchronize its system time to the network timeserver or a web- based time server.
9. The system shall have the ability to correct and power classroom secondary Analog clocks over the same Cat5e/6 cable drop also used for Two- Loudspeaking intercom speakers, call

switch and (optional) motion detector.

10. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.

1.2 CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

A. Safety and Indemnity

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 “1.5 A. Safety & Indemnity”.

B. Contractor Qualifications

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 “1.5 B. Contractor Qualification”.

C. Quality Assurance

1. Contractor shall comply with all requirements as specified in Section 270000 “1.5 Quality Assurance”.

D. Warranty

1. Contractor shall comply with all requirements as specified in Section 270000 “1.8. Acceptance & Warranties”.

1.3 SUBMITTAL DOCUMENTATION

A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270000 “1.6 Submittal Documentation”.

B. Contractor shall also include in their Submittal Package:

1. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection, and a complete schedule of all equipment and materials with associated manufacturers cuts sheets which are to be used.

   a. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
   b. Artwork drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
   c. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor’s name in the title block.
   d. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.

1.4 EQUIVALENT PRODUCTS

A. All Products described and Part Numbers given in this Specification are those of Telecenter manufactured by Rauland-Borg Corp unless otherwise noted.

B. Pre-Approved Equals:

1. Valcom (Class Connection).
2. Bogen Quantum MC2000

C. Owner will accept no substitutions from the three manufactures/products currently approved.

D. In addition, Contractor shall certify that the proposed system complies with the following statements:

1. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
3. Comply with NFPA 70
4. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools. .
5. Comply with UL 60950.

E. Not Equal:

1. Telecor
2. Teradon Raptor

1.5 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The system shall utilize state of the art VoIP Technology, Call-in Notification, School Safety Paging and Evacuation tones, Distributed (MDF/IDF) Electronic Architecture, Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way Loud Speaking Internal Intercommunications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.

B. Provide complete and satisfactorily operating school communications and School safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

C. The system shall be a single electronic system consisting of amplified intercom channels depending upon the configuration of the system, (classroom) speakers, corridor speakers, inside and outside horns, call-in switches, and master clock.

D. Features offered by this system shall be implemented and controlled by a software program that can be changed and expanded as customer needs evolve.

E. The system shall lend itself to expansion by simple addition of hardware modules.

F. The system shall allow the implementation of bell schedules that are managed via the WAN/LAN. The system shall directly connect to the WAN/LAN without the need for a separate computer at the school location. Bell schedules can remotely be created, changed, stored and downloaded to the system by an authorized user from a browser- based interface.

G. The system shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility. The system must also allow the implementation of a district-wide announcement system where live messages, pre- recorded announcements and emergency tones can be triggered via a telephone or browser-based user interface.

H. The system shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands free and will not require any interaction by the end-user to answer.

I. Room speakers, call switches, shall be programmable and may be assigned any two-, three-, four- or five-digit number. Any extension may be reassigned at any time, and it shall not be dependent on wiring or circuit numbers.

J. Amplified two-way voice communication shall be available from any provided telephone through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation.

K. Integrated Master Clock with unlimited schedules, unlimited events, and automatic Daylight Savings time correct. Up to 5 schedules may be active on any given day. User shall be able to select from 16 tone options or user created .wav files for class change signaling. In addition, the system shall allow unlimited user defined class change tones to be recorded. The system shall allow control of the bell schedules via the district WAN/LAN. The system shall directly connect to the WAN/LAN without the need for a separate computer at the school location. Bell schedules can remotely be created, changed, stored and downloaded to the system by an authorized user from a browser-based interface.

L. Ability to correct and power secondary clocks using the same Cat/6 cable drop (district standard) used for intercom speaker, call switch and (optional) motion detector.

2.2 EQUIPMENT AND MATERIAL

A. VoIP Based Controller (Gateway) Rauland-Borg Telecenter Series – with the following features and capabilities:

1. The ability to network multiple controllers via the LAN to provide a single interconnected system within the facility. The networking capability must provide for total transparency between controllers and in turn operate as a single system.
2. On-site or off-site diagnostics shall be capable via a standard Ethernet port for factory-trained personnel. The controllers shall tie directly into the LAN. In addition, all bell scheduling tasks must be browser based allowing authorized access from off-site district staff. On-site facility staff may also perform these tasks in the same manner as the district staff.
3. System shall connect to the district provided Telephone Network via an analog trunk, or station port.
4. The VX Works based Operating System and system programming database shall be stored in non-volatile flash memory. The Operating System can be easily upgraded through a configuration program without requiring replacement of any chips. The system programming database can be easily archived.
5. Support a flexible numbering plan allowing two-, three-, four-, or five-digit extensions. The two, three, four, and/or five-digit extensions can be intermixed within the same facility. Each extension can include leading or trailing alpha digits to match a facility's room numbering scheme.
6. Multiple attendant positions via district provided Telephone Network shall be capable of answering internal intercom call-ins a minimum of one (1) Marquee Display shall be provided.
7. Personal Identification Numbers (PIN's) shall be available for all staff. By dialing their PIN at any provided telephone, the staff member shall have access to the School Internal Intercom and Public Safety Network.
8. Reports on feature usage, system activity, etc. shall be available upon request either on site or remotely.
9. Direct Dialing, two-way amplified voice intercom between any provided telephone and speaker without the use of a press-to-talk or talk-listen switch.
10. DISA: Direct Inward System Access. The system can be configured to allow access to all system features/functions (paging, intercom, evacuation tones, class tone schedule selection, etc.) from any offsite DTMF dialing telephone via the district provided Telephone Network. Only authorized individuals may use this feature by dialing into the system through a dedicated trunk number, with or without a pass code, and then dialing a system function.
11. Ability to place two levels of call-in from any call in switch.
12. The ability to answer intercom call-ins registered at pre-selected telephones.
13. The ability to automatically reroute incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
14. Call switches and analog clocks shall be wired using a single Category 5e/6 cable. Wiring for all speaker, analog clocks, and call switch shall be with one Cat 5e/6 cable drop per location. Systems requiring a custom cable plant will not be acceptable.
15. The ability to remotely locate VoIP Controller(s) (Gateways) among MDF and IDF equipment closets. This flexibility allows for the most economical wiring of the system based on the layout of the facility thus eliminating the need for individual home run wiring per previous standard.
16. The ability to initiate Class of Service changes either manually or automatically on a per station basis based on time of day, day of the week, and calendar via the integrated master clock.
17. A minimum of sixty-four (64) unique Classes of Service shall be available.
18. Ability to perform any system feature or function from any authorized telephone.

B. Intercom/Paging/Tones/Clock Correction Module

1. Provide an integrated intercom module for individual room intercommunications, all page and

zone page, evacuation tones, prerecorded messages, multilevel call-in, secondary clock correction, and class change tones. The module shall be from the same manufacturer as the VoIP Controller (Gateway) to ensure compatibility. The module shall integrate directly with the VoIP Controller and will not require analog or digital tie lines to the VoIP Controller. Module shall provide the following integrated features and functions that integrate seamlessly with the VoIP Controller:

a. Two-way communication between any telephone and any room speaker.
b. Preannounce tone prior to connecting any intercom conversation to alert the user to the call and prevent unauthorized monitoring. A tone shall be automatically repeated at regular intervals for the duration of the intercom call if the voice circuit is not activated. A requirement to meet existing privacy laws.
c. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
d. Single button access from any telephone on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.
e. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. Up to Sixteen (16) separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
f. The system will have the ability to utilize a web-browser and USB microphone to deliver live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
g. The system can automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
h. Multilevel call-ins can be placed from either a classroom telephone or a call-in switch. The call-ins route to select or all administrative telephones and can only be cleared from the system once answered from an administrative telephone. If a call-in is not answered within a preprogrammed time the call-in may reroute to other administrative telephone(s) announce over selected or all speakers and shall have the capability to also reroute calls to predefined Mobile telephones. Emergency Call-ins may can also be programmed to send e-mail alerts to specific addresses
i. An option for Privacy call-in switches. When the Privacy switch is activated it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
j. Classroom teachers shall have the capability to exclude pages and tones from their individual classroom for testing or other purposes. This exclusion cannot affect emergency pages. This exclusion will reset at midnight.
k. An option for Call Assurance call-in switches. When the normal or emergency button is pressed, an LED lights up to visually confirm that a call-in has been placed.
l. The system can automatically alter a call switch’s class of service by time of day and date via the integrated master clock.
m. The capability to assign speaker locations to any one or more of the sixteen (16) independent zones for zone paging, sixteen (16) independent program/music distribution zones and sixteen (16) independent class change tone reception; this assignment is a programmable function. Each location shall be programmed in software to belong to any combination of software zones. Software/hardwired zones must be configured as part of an unlimited number of district wide groups for school district emergency announcements. These district announcements must be accessed via microphone, a web-

browser or telephone.

n. Automatic class change tones sent through all or selected intercom/paging speakers and/or horns. Any combination of up to Sixteen (16) tones can be sounded to indicate different events. Up to sixteen (16) different class change schedules can be stored in the system and selected manually from an administrative telephone, web browser or selected automatically based on time, day of the week, and date. Tone type and duration are selectable for each class change event. An unlimited number of class change events can programmed as part of the system.

o. Programmable "Music-on-Class-Change." A program source can be automatically routed to select zones of paging speakers or all speakers within the facility during each class change period.

p. The system shall provide facilities to distribute program material (i.e. cassette tape, CD, radio broadcasts) in the following manner:

1) The user shall cue remotely located music source or select radio station.
2) From an Administrative Telephone the user can select the room(s) or areas to distribute program.
3) Automated distribution based on event schedule.

q. The module provides for secondary clock correction with the following features and functions:

1) User programmable Automatic Daylight Savings Time Change.
2) Latched operation of zone outputs to control lighting or other devices.
3) Interface with most types of secondary slave clocks whether synchronous wired, wireless or electronic.
4) User-programmable custom slave clock correction. Output relays rated at 5 amperes shall be provided on all zone circuits as necessary.
5) Ability to correct and power secondary clocks using same Cat5e/6 supporting intercom speakers, classroom telephone, call switch and motion detector. Secondary clocks requiring more than 15 mA shall not be acceptable.

r. System has the ability to sync system time to the Atomic Clock Signal or to the school's or districts network time server. System has the ability to offset system time (+) or (–) 15 minutes from true atomic time to accommodate bus schedules or other scheduling issues.

s. The module provides for classroom security and call switch supervision with the following features and functions:

1) All field wiring to call switches connected to the system shall be capable of individual supervision for opens or shorts.
2) System shall be capable (future) to accept multiple alarm inputs from the main security and/or fire alarm system. Emergency tones and/or announcements can therefore be triggered, via the primary security and/or fire alarm system, to provide redundant annunciation using the classroom and corridor speakers.

t. Intercom and paging speakers/horns can be assignable to any one or more of the sixteen (16) zones for zone paging, up to sixteen (16) zones for program distribution, and sixteen (16) zones for class change tones. Any of these zones may be part of a district created emergency paging zones allowing paging groups of different facilities within the school district. All these zones may be configured to be independent of the other zones and in any combination. Initially, paging zones shall be provided for the following:

1) Grade 1
2) Grade 2
3) Grade 3

4) Grade 4
5) Grade 5
6) Grade 6
7) Grade 7
8) Grade 8
9) Teachers' lounge and workrooms.
10) Common Areas
11) Administrative Areas
12) North Outside Speaker Area
13) South Outside Speaker Area
14) West Outside Speaker Area
15) East Outside Speaker Area
16) Gymnasium

C. Normal/Emergency Call Switch – Rauland TCDCS2 Dual Level Call In Switch w/led and Cancel

1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:

   a. One (1) "Normal" call switch that shall activate a distinctive "NORM" level call from a single button activation. The button shall be clearly marked "NORM" and will route the call-in to any one or more Administrative Telephones and/or Marquee Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the "Normal" call will provide a steady call assurance LED confirming that the call has been placed in the system.
   b. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from a single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the "EMERGENCY" call will provide a flashing call assurance LED confirming that the call has been placed in the system.

D. Audio Paging/Program Amplifiers

1. Power amplifier(s) shall be provided to provide a minimum of ½ watt of power to all intercom speakers, 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.

E. Interior Recess-mounted Wall/Ceiling Speakers

1. Provide premium quality 8" cone transducer speaker. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. The speaker shall have a frequency response of 65 Hz to 17 kHz with a power rating of 8 watts. Sensitivity shall be 93 dB, 1 watt, 1 meter. Voice coil shall be ¾" diameter with a 5-ounce magnet. When installed in ceiling, no speaker assembly weight shall be resting on any ceiling tiles.
2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4"x10-3/4"x3-3/4" deep and shall be capable of accommodate the clock speaker baffle in locations designated.
3. The surface mount clock/speaker back box shall be of 22 gauge cold-rolled steel, with baked powdered epoxy cool gray finish. Supports either vertical or horizontal mounting. The surface mount clock/speaker back box shall be 20.18" x14.26" x2.78" deep.

4. The baffle shall be constructed of a one-piece, 22 gauge cold-rolled steel, zinc- treated to prevent corrosion. The finish shall be white baked powdered epoxy and be virtually scratch/mar proof. The baffle perforation pattern shall be designed for wide sound dispersion and screw attachment to top of the back box.

F. Exterior Recessed Wall Mounted Horns

1. Unit shall be double re-entrant type with compression driver mounted within weather-resistant housing. Audio power capability shall be 15 watts continuous. Frequency response shall be 600-14,000 Hz 700-5500 Hz (+ or – 5dB). Sound pressure level shall be 114dB (15W/1M). Sound dispersion angle shall be 95 degrees. Transformer equipped loudspeaker shall have impedance selection via seven position switch of 5000, 2500, 666, 333, 89, and 45 Ohms. Power taps shall be available .48, .94, 1.8, 7.5, and 15 watts on 25V line; 1, 2, 3.8, 7.5, and 15 watts on 70.7V line and 15 watts on 100V line. Loudspeaker mounting shall be by eight 3/16 “evenly spaced holes. Model APF-15T dimensions shall be Dia. 5 3/8” x D 5 3/16” x Dia. Of flange 6 5/16”; Finish shall be grey baked epoxy.

   Speaker shall be Atlas Sound APF-15T, No Substitutions.

G. Exterior Surface Wall or Ceiling Mounted Horns

1. Unit shall be double re-entrant type with compression driver mounted within weather-resistant housing. Audio power capability shall be 15 watts continuous. Frequency response shall be 600-14,000 Hz 700-5500 Hz (+ or – 5dB). Sound pressure level shall be 114dB (15W/1M). Sound dispersion angle shall be 95 degrees. Transformer equipped loudspeaker shall have impedance selection via seven position switch of 5000, 2500, 666, 333, 89, and 45 Ohms. Power taps shall be available .48, .94, 1.8, 7.5, and 15 watts on 25V line; 1, 2, 3.8, 7.5, and 15 watts on 70.7V line and 15 watts on 100V line. Loudspeaker mounting shall be by eight 3/16 “evenly spaced holes. Model APF-15T dimensions shall be Dia. 5 3/8” x D 5 3/16” x Dia. Of flange 6 5/16”; Finish shall be grey baked epoxy.

   Speaker shall be Atlas Sound APF-15T, No Substitutions

H. Accessories

Recessed Mounting Back Box

1. Unit shall be a Durable Enclosure Designed to Recess Mount VP 161 Series Vandal Proof Baffles. The Unit Accommodates A Wide Variety of Loudspeaker/Transformer Configurations. The Unit Shall be Constructed of Heavy-Duty 18 Gauge Stainless Steel Including Undercoating and a Natural Finish. The Unit Shall be designed for use with Atlas Sound VP 161 Series Vandal/Weather resistant Baffles.

   Back Box shall be Atlas Sound 161RES; No Substitutions.

Surface Mounting Back Box

1. Unit shall be designed to Surface Mount VIP161 Series Vandal Proof Baffles. The Unit shall accommodate a Wide Variety of Loudspeaker/Transformer Configurations. The Unit Shall be Constructed of 18 gauge Stainless Steel Construction Including Undercoating and a White Powder Coat Finish. The Unit Shall be Weather-Resistant and Suitable for Outdoor Use.

   Back Box shall be Atlas Sound 161SES; No Substitutions.

Recessed Vandal-Proof Baffles

1. Unit shall offer tamperproof protection for cone loudspeakers and re-entrant horns. Unit is constructed of special aluminum allow providing twice the strength of conventional cast aluminum baffles. Unit comes in attractive square (Our standard) or round models to meet varying applications and aesthetic requirements.

   Recessed Baffle shall be Atlas Sound VP161-APF; No Substitutions

I. Uninterruptible Power Supplies (UPS)

1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
2. UPS equipment will be sized in accordance with the system manufacturer's recommendations.
3. Provide an individual UPS for EACH SYSTEM CONTROLLER (Gateway) furnished with the system.
4. Provide additional UPS(s) for protection of all other equipment furnished with the system and housed in the equipment racks.
5. All UPS equipment shall be rack mounted and assigned an IP address for network communication. Contact Owner for assigned IP address.

J. Equipment Racks

1. All equipment racks shall provide 44 spaces (77") minimum for mounted system equipment.
2. All equipment racks shall be multi-rack format ("gangable") style, bolted together, and open cavity.
3. All equipment racks will be provided with lockable rear doors.
4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
6. Rack mounted equipment shall be accessible from front and rear.
7. All unused rack spaces will be covered with appropriate blank/vent panels.
8. The intercom p.a. source equipment will mount in these approved data racks at a good working level approximately shoulder height.
9. The cables to/from the source equipment must be terminated on 66-M150 telephone type punch blocks and NEVER on 110 computer type punch blocks. The 66-M150 punch blocks must be snapped onto 89B brackets, and the 89B brackets must be mounted to telephone style blue boards either half or full size as necessary.
10. The blue boards must be mounted to one of the appropriate equipment room walls at a good working height.
11. The "house" cables for the speakers and any feeder cables must also be terminated on 66-M150 cables, NEVER on 110 type blocks.

K. Analog Secondary Clocks

1. Analog clocks shall be designed to provide long term maintenance free timekeeping in any commercial application with a five (5) year manufacturer's warranty.
2. Analog shall correct for time, hour, minute and second hands.
3. The analog clock shall have an internal clock that can keep time for up to six (6) hours after a power failure without the use of batteries.
4. Typical recovery time after power failure shall be less than 2 minutes.
5. 12 inch analog clocks shall be supplied in all classrooms, administrative areas and common

areas as indicated on the plans. 16 inch analog clocks shall be provided in auditoriums, and gymnasiums with protective cover,

6. In areas designated a clock/speaker baffle combo unit shall be supplied either surface or wall mounted depending on site condition.

L. Wireless Clock System

1. Provide complete and satisfactorily operating NTP Synchronized Wireless Clock System with analog clocks as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated.
2. (NTP) Network Time Protocol is a network standard protocol that assures accurate synchronization to the millisecond of computer clock times in a network of computers. Based on UTC, NTP synchronizes client workstation clocks to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs, CO. Running as a continuous background client program on a computer, NTP sends periodic time requests to servers, obtaining server time stamps and using them to adjust computer clocks.
3. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.
4. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information.
5. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
6. The NTP Synchronized Wireless System consists of a master transmitter located on the inside of the building, and a NTP receiver connected to a time server. An unlimited number of wireless analog clocks are synchronized to the NTP time. System shall synchronize all clocks to each other. System shall utilize NTP technology to provide atomic time to components.
7. System shall not require hard wiring for its components except for AC Power. Analog Clocks may be battery operated for full portability if required.
8. Analog Clocks shall synchronize to +/- 1 second of the transmitter displayed time.
9. Clocks shall automatically adjust for Daylight Saving per settings on the transmitter
10. The system shall have an internal clock that is continually updated by the NTP receiver. If a NTP failure were to occur, the clocks would continue to be synchronized to the internal clock and would not deviate from each other. Once NTP time is restored, all clocks would once again be synchronized to the NTP time.
11. The system must have a failsafe design so that if a power interruption were to occur, the clocks will continue to operate. If a synch signal is not received by the analog clocks for 48 hours, the second hand will double pulse to indicate this condition. Upon restoration of power, the transmitter will once again communicate with the clocks and normal operation will resume.
12. Battery Powered Analog Clocks shall require 2 "D" cell batteries.
13. System shall be 100% programmable from the front operational panel with lights that indicate power status and NTP reception. Panel programming will also include Time Zone, Frequency, 12 or 24 hour operation and DST on/off.
14. The wireless backbone must support expansion of the system to include wireless alphanumeric displays for emergency crisis communications for district-wide communications.
15. The system may be modified to use GPS instead of NTP as the time source without the need to replace the transmitter. A GPS receiver would need to be added with access to the outside of the building.
16. The system shall lend itself to expansion by simple addition of wireless secondary clocks and their required power source.
17. EQUIPMENT AND MATERIALS

    a. WIRELESS TRANSMITTER

        1) FCC Part 90 Approved, 467.2125-467.4375 MHz frequency range

2) Radio Technology (Narrowband FM, 12.5 KHz bandwidth)
3) 10 selectively available channels
4) 5 watt transmitter
5) Daylight Savings Time pre-programmed
6) Time Zone Pre-set
7) Non-Volatile Memory
8) LCD Display for time, date, year, power, time zone and signal reception
9) Operating Range (32 degrees F to 158 degrees F)
10) Rack or Shelf Mount
11) Power Supply Input: 120-volt AC, Output: 12-volt DC, 3 Amps
12) 7" Rear Mounted Antenna
13) Dimensions: 12"L x 6"W x 1.75"H Weight: 2 lbs
14) NTP Receiver
15) Optional External Antenna for use in large campus applications. Up to 2 miles radius

b. SECONDARY 13" ANALOG CLOCK

1) 13" Analog Clock (Battery Powered using 2"D" Cell batteries).
2) Maintenance Free.
3) Five year manufacturer's warranty.
4) Microprocessor based with built-in wireless receiver
5) Heavy Duty Construction
6) Durable ABS Casing
7) Clock numbering graphics shall be Standard Arabic Format (12HR- 60 Minute)
8) Face of clock is white
9) Hour and Minute hands shall be black, second hand is red
10) The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
11) The clock shall have a low–profile, semi–flush design
12) Wire Guard Model in areas where protection is required as indicated on drawings or by owner.

c. SECONDARY DUAL FACE 13" ANALOG CLOCK

1) 13" Analog Clock (Battery Powered using 2"D" Cell batteries per face)
2) Wall or Ceiling Mount shall be determined by drawings or owner
3) Maintenance Free.
4) Five year manufacturer's warranty
5) Microprocessor based with built-in wireless receiver
6) Heavy Duty Construction
7) Durable ABS Casing
8) Clock numbering graphics shall be Standard Arabic Format (12HR- 60 Minute)
9) Face of clock is white
10) Hour and Minute hands shall be black, second hand is red
11) The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.

d. SECONDARY 16" ANALOG CLOCK

1) 16" Analog Clock (Battery Powered using 2"D" Cell batteries).

2) Maintenance Free.
3) Five year manufacturer's warranty.
4) Microprocessor based with built-in wireless receiver
5) Heavy Duty Construction
6) Durable ABS Casing
7) Clock numbering graphics shall be Standard Arabic Format (12HR- 60 Minute)
8) Face of clock is white
9) Hour and Minute hands shall be black, second hand is red
10) The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
11) Wire Guard in areas where protection is required as indicated on drawings or by owner.
12) The clock shall have a low–profile, semi–flush design

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Furnish and install all material, devices, components and equipment for a complete operational system.

C. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. All housings are to be located as indicated.

F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system

conductors.

I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.3 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 FINAL ACCEPTANCE TESTING

A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner’s Representative establishing the “In Warranty” date. The warranty period will not commence until the Final Acceptance Test is completed. This document MUST list either the extension number, port number, or some other means so the owner will be able to look at the location of a speaker and cross reference it’s number/port on this list as to be able to make programming Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety

Network.

C. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

D. Furnish and install all material, devices, components and equipment for a complete operational system.

E. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

F. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

G. All housings are to be located as indicated.

H. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

I. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

J. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

K. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

L. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

M. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

N. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

O. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices.

P. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

Q. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting

wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

R. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

S. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

T. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed. This document MUST list either the extension number, port number, or some other means so the owner will be able to look at the location of a speaker and cross reference it's number/port on this list as to be able to make programming bell/zone type changes.

U. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

V. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing". Again, these drawings MUST show the extension/port number of every speaker in the system.

W. System Training: Submit the following information describing the training programs and system trainers in accordance with the specifications.

a. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
b. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
c. Include with the submittal a current copy of trainer's need's assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
d. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

3.6 COMMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6, paragraphs 3, 5 & 6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the owners representative, with at least seven days advance notice.

3.7 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6, paragraph 9 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.8 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION

SECTION 28 00 00 - ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures

B. Section 26 00 00 – Electrical

C. Section 27 20 00 – Data Communications

1.2 SCOPE

A. This section provides the minimum requirements for Electronic Safety and Security Systems. Additional requirements are to be found in subsections of this specification.

1.3 SUBMITTALS

A. General Requirements

1. All submittals shall be made in accordance with section 01 33 00.

B. Licensure

1. Submit proof of possession of a valid C-7 California State Contractor's License in good standing.

C. System Submittals and Shop Drawings

1. Submit a complete list of equipment and materials proposed for the system with catalog cuts, technical data, manufacturer’s Specifications and detail drawings.
2. Submit a complete set of detailed, scaled Shop Drawings of all racks, cabinets, and equipment, with all designations, dimensions, color, controls, wiring, and schematic diagrams of all circuits. Show interfaces to all equipment furnished, including equipment furnished by other contractors, identifying numbers of wires, termination requirements, voltages and other pertinent details. Include front elevations, cabinet dimensions, types of mounting, door barriers, catalog number of locks and finishes of terminal cabinets.

D. Spare Parts Data

1. After shop drawings are approved, and not later than thirty (30) calendar days prior to the date of beneficial occupancy, a list of spare parts data for each item of specified materials and equipment shall be submitted. The data shall include a complete list of parts and supplies with current unit prices and source of supply.

E. Operating and Maintenance Documents

1. The contractor shall furnish to the architect (3) copies of operating and maintenance instructions.
2. Documentation shall outline the step-by-step procedures required for system start-up, operation, and shutdown.

3. Documentation shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides.
4. Documentation shall be submitted at least thirty (30) calendar days prior to acceptance test. The instructions shall include the manufacturer's name, system model number, service manual, parts list, and a description of all equipment and their basic operating features.

F. Warranty

1. A copy of the manufacturer's warranty for all equipment and materials shall be provided.

G. Close-Out Documents

1. Upon completion of the installation, the contractor shall provide four copies (one hard copy and three electronic copies) of Project Close-Out Documents to the District. Documentation shall include the items detailed below.
2. As-Built Drawings

   a. The contractor shall provide a complete set of as-built drawings for the entire system upon installation completion.
   b. These drawings shall include, but not be limited to, the exact locations of all equipment, connections between all equipment, and wiring for all equipment as the system is installed.
   c. printout of configuration

3. All System source codes and passwords (Crestron Programs) must be handed over to, and become property of the District upon completion of this project.

H. All submittals called for shall be instruments of the Contractor, even though they may have been prepared by a subcontractor, supplier, dealer, manufacturer, or by any other person, firm or organization. Prior to submission, the Contractor shall undertake its own review and stamp with its acceptance prior to submittal.

1.4 SCOPE OF WORK

A. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required to accomplish work indicated or specified in this or other sections, it shall be the responsibility of the Contractor to provide all materials and equipment which is usually furnished with such systems in order to complete the installation, whether or not specifically mentioned herein.

1.5 APPROVAL

A. Installation of the system shall not commence until all approvals are granted by the Division of the State Architect (DSA).

B. Installation of the system shall not commence until all shop drawings and submittals are approved by the School District, Architect of Record, and Engineer of Record.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications

1. Must hold a valid State of California C-7 license in good standing;

2. Must have completed at least three (3) projects of equal scope within the last three (3) years;
3. Must maintain a service office within 50 miles of the project;
4. Must be bonded to assure performance and satisfactory service during the guarantee period;
5. Contractor must be registered with BICSI and have at least one RCDD on staff;
6. Must have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .DWG or .DXF format.

B. All equipment and wiring shall be furnished and installed by the authorized factory distributor of the equipment. The manufacturer's representative of each system shall provide a letter from the manufacturer of all major equipment with submittals stating that he is the representative and that the manufacturer will have a service representative assigned to this area for the life of the equipment.

C. The Contractor shall furnish a letter from the manufacturer of the equipment specified, which certifies that the equipment has been installed according to factory recommended practices and that the system is operating satisfactorily.

D. The Contractor shall provide not less than sixteen (16) hours of instruction to personnel in the operation, programming, and maintenance of each system. This instruction time shall be divided up as directed by the District.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials from damage during handling and installation.

1.8 COORDINATION

A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems, fire alarm systems, HVAC systems, security systems, etc., as applicable.

1.9 WARRANTY

A. The entire system shall be guaranteed free of mechanical or electrical defects for a period of one year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District. Guarantee period shall begin from the date of final acceptance by the District.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. References to manufacturer's model numbers and other information is intended to establish minimum standards of performance, function, and quality. Equivalent equipment from the specified manufacturer's may be substituted for the specified equipment, as long as the minimum standards are met.

PART 3 – EXECUTION

3.1 GENERAL

A. All Work described in this specifying documents and on the Project drawings shall be performed in accordance with the acknowledged Professional and industry standards and practices. All installed equipment shall meet or exceed the specified manufactures regulations.

B. Materials shall be installed in strict compliance with all local, state, county, province, district, federal and other applicable building, safety, and fire standards, laws, codes, regulations, and guidelines including, but not limited to, all appendices and amendments and the requirements of the local authority having jurisdiction (AHJ).

B. Examine areas and surfaces to receive each system.

1. Notify Architect of conditions that would adversely affect installation or subsequent use.
2. Do not begin installation until unacceptable conditions are corrected.

D. The Contractor shall maintain a competent Supervisor and Manufacturer Certified Technicians assigned to this installation for the duration of the Project.

E. Furnish and install all materials, devices, components and equipment required for a complete and operational system.

F. It is the Contractor's responsibility and obligation to coordinate with all necessary trades to ensure that the integrity of and compliance with Manufacturer and industry standards are met during the duration of the installation.

3.2 INSTALLATION

A. Furnish control panels, components, devices, cabinetry, wire, connectors, materials, parts, equipment, labor, etc. necessary for the complete installation of the systems in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

B. Coordinate the required space in Data equipment frames with this and other network based Communications systems that may share rack space. Provide racks with sufficient space to accommodate patch panels, switches, power supplies, etc. for all network interfaced systems.

C. Installations shall follow standard wiring and installation practice, and shall meet or exceed industry standards of such work.

D. Wire not installed in equipment racks, not portable, in unrated ceiling space, or not installed in conduit shall be fire rated and meet all applicable codes.

E. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer, CEC, and NEC.

F. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items which produce heat.

G. Furnish each system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.

H. Shields of audio cables shall be grounded at one end only, at the input side of all equipment items in the system.

I. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that constant polarity is maintained.

J. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (data, fire alarm SLC, fire alarm NAC, speaker, intrusion, etc.) by as much physical distances possible. Neatly arrange and bundle all cables loosely with Velcro cable ties. Cables and wires shall be continuous lengths without splices.

K. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.

L. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.

N. Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections. All labeling shall be completed prior to final system inspection.

3.3 PROGRAMMING

A. Contractor shall provide all necessary programming to provide complete operating systems.

C. Contractor shall include in their bid one (1) four (4) hour planning meeting with the District and their Representatives for each system to outline all specific programming issues for each system, as well as, but limited to:

1. Contractor will be informed of any specific requirements for use of the system.
2. Contractor will provide overview of system capabilities.
3. Contractor will address all concerns of the District and their Representatives.

C. Contractor shall include in their bid one (1) four (4) hour planning meeting with the District and their Representatives for each system, scheduled at least six (6) months after job final, to review the system performance and modify programming as needed. Programming modifications shall be provided at no cost to the District.

3.4 TESTING

A. Completed systems shall be physically inspected by the District's representative to assure that all equipment is installed in a neat and professional manner and in accordance with these Specifications.

B. Final systems testing and commissioning shall be performed after all installation and initial testing has been completed by the Installer, but prior to any use of the systems.

C. The Contractor, prior to requesting systems testing and demonstration to the District's representative, shall ensure that all systems are in first-class working condition and free of shorts, ground faults/loops, parasitic oscillations excessive hum and noise, RF interference, or instability of any form.

D. The Contractor shall be responsible for properly performing all setup and alignment of the systems, and all assembly and setup of portable equipment.

3.5 COMMISSIONING

A. All testing documentation shall be supplied with the as-built documentation.

B. The Contractor will include in their bid price six (6) hours for onsite commissioning and will provide the installation technician who was responsible for this project to be present at the system commissioning to tune, fix, repair, and/or replace all system components that do not operate within the tolerance as set forth in the specifications, project documents, and industry standards.

C. The final acceptance of the system by the District will be based upon the report of its representative following inspection, testing, and commissioning. A list of items in need of completion or correction shall be generated the District, which must be corrected by the Installer before final acceptance will be granted.

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical

B. Section 26 20 00 – Low Voltage Electrical Transmission

C. Section 27 00 00 – Communications

D. Section 28 00 00 – Electronic Safety and Security

1.2 REFERENCES

A. Electrical Industries Association (EIA):

1. EIA-232-D – Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
2. TIA-485-A – Electrical Characteristics of Generators and Receivers for Use in Balanced Multipoint Systems

B. California Code of Regulations

1. Title 24, Part 3 – California Electrical Code (CEC)

C. National Fire Protection Association (NFPA):

1. NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems.
2. NFPA 13 – Installation of Sprinkler Systems.
3. NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection.
4. NFPA 16 – Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.
5. NFPA 16A – Standard for the Installation of Closed Head Foam-Water Sprinkler Systems.
6. NFPA 70 – National Electrical Code (NEC)
7. NFPA 72 – National Fire Alarm Code.
8. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.
9. NFPA 101 – Life Safety Code.
10. NFPA 750 – Standard on Water Mist Fire Protection Systems.
11. NFPA 5000 – Building Construction and Safety Code.

D. Underwriters Laboratories (UL):

1. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems.
2. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.
3. UL 1971 – Standard for Signaling Devices for the Hearing Impaired.

1.3 SCOPE OF WORK

A. Furnish all labor, equipment, and materials for, and comply with the performance requirements of the Fire Alarm System indicated in the drawings and specified herein.

B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required to accomplish work indicated or specified in this or other sections, it shall be the responsibility of the Contractor to provide all materials and equipment which is usually furnished with such systems in order to complete the installation, whether or not specifically mentioned herein.

1.4 SYSTEM DESCRIPTION

A. A new intelligent reporting, fully peer-to-peer, microprocessor-controlled fire detection and notification system shall be installed in accordance with the specifications and as indicated on the Drawings.

B. Basic Performance:

1. Network Communications Circuit Serving Network Nodes: Connected using approved fiber optic cable or 18/2 twisted pair copper cable between nodes.
2. Signaling Line Circuits (SLC) Serving Addressable Devices: Wired Class B.
3. Initiation Device Circuits (IDC) Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class B.
4. Notification Appliance Circuits (NAC) Serving Strobes and Horns: Wired Class B.
5. Alarm Signals Arriving at Control Panel: Not lost following primary power failure until alarm signal is processed and recorded.
6. Network Node Communications:

    a. Communicated between panels on fiber optic cables.
    b. To enhance system survivability, ability to operate on loss of Command Center, short or open of entire riser at Command Center shall be demonstrated at time of system acceptance testing.
    c. Systems that are not capable of providing true Style 7 riser performance shall not be acceptable.

7. Signaling Line Circuits (SLC):

    a. Reside in remote panels with associated audio zones.
    b. SLC modules shall operate in peer-to-peer fashion with all other panels in system.
    c. On loss of Command Center, each remaining panel shall continue to communicate with remainder of system, including all SLC and control functions Systems that provide a “Degraded” mode of operation upon loss of Command Center or short in riser shall not be acceptable.
    d. Limit the number of devices to 80% of the maximum allowed of each type on SLC circuits.

8. Notification Appliance Circuits (NAC), and Control Equipment:

    a. Arranged such that loss of any 1 NAC circuit will not cause loss of any other NAC circuit in system.
    b. Electrically supervised for open and short circuit conditions.
    c. If short circuit exists on NAC circuit, it shall not be possible to activate that circuit.
    d. Voltage drop is not to exceed 10% at the furthest point on any NAC circuit.

9. Standby Power:

    a. Provide a minimum of 20% spare battery capacity above calculated requirements.

C. Sequence of Operations:

1. General Alarm: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, or sprinkler water flow switch, the following functions shall automatically occur:
    a. The internal audible device shall sound at the control panel or command center.
    b. The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time/date.
    c. All system activity/events shall be documented on the system printer.
    d. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

        i. The notification signals and actions shown on the plans shall occur simultaneously.

2. Supervisory Operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:

    a. The internal audible device shall sound at the control panel or command center.
    b. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
    c. All system activity/events shall be documented on the system printer.
    d. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
    e. Transmit signal to the central station with point identification.

3. Trouble Operation: Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

    a. The internal audible device shall sound at the control panel or command center.
    b. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
    c. All system activity/events shall be documented on the system printer.
    d. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
    e. Transmit signal to the central station with point identification.

4. Monitor Operation: Upon activation of any device connected to a monitor circuit (fire pump/emergency generator status), the following functions shall automatically occur:

    a. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
    b. All system activity/events shall be documented on the system printer.
    c. Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

D. Fire Alarm System Functionality:

1. Provide complete, electrically supervised distributed, networked analog/addressable fire alarm and control system, with analog initiating devices.
2. Each Network Node: Incorporate Boolean control-by-event programming, including as a minimum AND, OR, NOT, and Timer functions.
3. Control Panels: Capability to accept firmware upgrades via connection with laptop computer, without requirement of replacing microchips.
4. Network:

    a. Based on peer-to-peer token ring technology operating at 625 K baud, using Style 7 configuration.
    b. Capability of using twisted-pair wiring, pair of fiber optic cable strands up to 200 microns, or both, to maximize flexibility in system configuration.

5. Each Network Node:

    a. Capability of being programmed off-line using Windows-based software utilized by fire alarm system manufacturer. Capability of being downloaded by connecting laptop computer into any other node in system. Systems that require system software to be downloaded to each transponder at each transponder location shall not be acceptable.
    b. Capability of being grouped with any number of additional nodes to produce a “Region”, allowing that group of nodes to act as 1, while retaining peer-to-peer functionality. Systems utilizing “Master/Slave” configurations shall not be acceptable.
    c. Capability of annunciating all events within its “Region” or annunciating all events from entire network, on front panel LCD without additional equipment.

6. Each SLC Network Node: Capability of having integral DACT (digital alarm communicator transmitter) that can report events in either its region, or entire network to single central station monitoring account.
7. Each Control Panel: Capability of storing its entire program and allow installer to activate only devices that are installed during construction, without further downloading of system.
8. Password Protection: Each system shall be provided with 4 levels of password protection with up to 16 passwords. Passwords shall be provided to owner.

1.5 QUALITY ASSURANCE

A. To ensure reliability and complete compatibility, all items of fire alarm system, including control panels, power supplies, initiating devices, and notification appliances, shall be listed by Underwriters Laboratories Inc. (UL) and shall bear the “UL” label.

B. Fire Alarm Control Panel Equipment: UL-listed under UL 864 Ninth Edition.

C. Equipment, Programming, and Installation Supervision:

1. The contractor is required to hold a C-10 license and any other certifications required by the Authority Having Jurisdiction.
2. The contractor is required to be an approved engineered systems distributor of Gamewell-FCI for equipment, programming, and installation supervision.
3. Proof of factory training shall be delivered within 14 calendar days of award of the Contract.

D. Software Modifications:

1. Provide services of Notifier factory-trained and authorized technician to perform system software modifications, upgrades, or changes.
2. Provide use of all hardware, software, programming tools, and documentation necessary to modify fire alarm system software on-site.
3. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones.
4. System structure and software shall place no limit on type or extent of software modifications on-site.
5. Modification of software shall not require power-down of system or loss of system fire protection while modifications are being made.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials from damage during handling and installation.

1.7 COORDINATION

A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems, elevators, HVAC systems, and security/door locking systems, as applicable.

1.8 WARRANTY

A. Warranty Period for System Equipment: 1 year from date of final acceptance.

B. Trouble Calls: The contractor shall guarantee on-site service for the Fire Alarm System within 24 hours of the receipt of a trouble call.

1.9 SUBMITTALS

A. Shall be in accordance with section 280000 and the General Conditions.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Refer to the plans for manufacturers and part numbers.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive fire alarm system.

1. Notify Architect of conditions that would adversely affect installation or subsequent use.

2. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install fire alarm system in accordance with NFPA 72, NFPA 70, state and local codes, manufacturer's instructions, and as indicated on the Drawings.

B. Smoke detectors shall neither be installed within 36 inches of any HVAC supply or return air grille, to include air handling light fixtures, nor within 12 inches of any wall.

C. Smoke detectors shall not be installed before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.

D. Wall mounted notification appliances shall be installed not lower than 80 inches and not higher than 96 inches, above finished floor. Devices shall be not be mounted within 6 inches of the ceiling.

E. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated in the Contract Documents not meet this requirement, it shall be the responsibility of the Contractor to bring it, in writing, to the attention of the Engineer.

F. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.

G. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install stations at 48 inches above finished floor, measured to operating handle.

H. End of Line Resistors shall be furnished as required by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled so as not to require removal to identify the EOL device.

I. Addressable modules shall be mounted within 36 inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, shunt trip, sprinkler status points, or door release. Label all addressable modules as "FIRE ALARM SYSTEM" and to their function, e.g., "FAN F-1 SHUTDOWN".

J. Conduit/Raceways, Junction Boxes:

1. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems may be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
2. The fire alarm system cabling / wiring shall be installed in RED color conduit, minimum size 3/4". In upgrade projects, existing fire alarm system conduit may be reused, if serviceable. Paint existing conduits red to match new.
3. All junction box covers shall be painted red.
4. Minimum conduit size shall be 3/4" trade size.
5. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas. Concealed installation is preferred wherever possible.

K. Cables & Conductors:

1. Cables & conductors shall be labeled at both ends as to their origin and destination; e.g. "FACP - i1-1" indicates the origin as the FACP and the destination as initiation device "i1-1". Utilize Panduit labels (or equivalent), size MP-150c through MP-350, as required by the amount of information on the label.
2. Splices in wiring are permitted only at terminal cabinets, or locations specifically approved by the Engineer. Do not splice in conduit, pull boxes, inaccessible locations, etc.

L. Terminal Cabinets:

1. Wiring shall be neatly bundled, fanned, tagged, and laced. Leave minimum three inches fan space between terminal block connection and vertical wiring. Incoming wiring shall terminate on the left, outgoing on the right.
2. Wire terminations at devices and terminal strips shall be "spade" type terminal connections, Sta-Kon, or equivalent.
3. Terminal barrier strips shall be Cinch 142 series (or equivalent) with minimum six points. Leave minimum two space separation between types of system cables. Provide minimum four spare termination points.

M. Coordinate the required space in the Data equipment frames with this and other network based systems. Provide racks with sufficient space to accommodate all systems.

3.3 SYSTEM UPGRADES

A. When upgrading an existing system, the existing fire alarm shall be tested in the presence of an assigned representative of Central Unified School District prior to any work being started by a contractor. Upon completion of testing, it shall be the contractor’s responsibility to note any discrepancy with the existing system. It will be contractor’s responsibility to provide and complete a working system, minus any discrepancies noted.

B. When upgrading an existing system, all end of line resistors shall be changed out to meet the manufacturer’s specifications for each fire panel. Install the latest software updates on existing equipment to be reused.

C. When specifications call for the removal of existing equipment, that equipment shall be returned to the District.

3.4 FIELD QUALITY CONTROL

A. Manufacturer’s Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.

B. Testing:

1. Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.
2. Close each sprinkler system control valve and verify proper supervisory alarm at Control Panel.
3. Verify activation of flow switches.
4. Open initiating device circuits and verify that trouble signal actuates.
5. Open signaling line circuits and verify that trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground initiating device circuits and verify response of trouble signals.

8. Ground signaling line circuits and verify response of trouble signals.
9. Ground notification appliance circuits and verify response of trouble signals.
10. Check installation, supervision, and operation of intelligent smoke detectors.
11. Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at Control Panel and correct activation of control points.
12. Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.

C. Acceptance Testing:

1. The contractor's job foreman and an assistant, in the presence of a representative of the manufacturer, an assigned representative of Central Unified School District, and the assigned inspector of the AHJ, shall perform a test of the system. All attending personnel shall be given reasonable notice so as to make themselves available for the test.
2. Operate every installed device to verify proper operation and correct annunciation at the control panel.
2. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.
3. Completely disconnect main Control Panel from rest of network. Activate initiating device. All control outputs supported by transponder SLC circuits shall operate under project programming mode. Default or degrade mode programming shall not be acceptable.
4. Complete any additional testing required by the AHJ.
5. When testing has been completed to satisfaction of both Contractor's job foreman, representatives of the manufacturer and Owner, and the inspector of the AHJ, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to the Owner and fire department.
6. Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) from date of final acceptance by the owner.

3.5 DEMONSTRATION

A. Provide 4-hour's instruction class to the district's designated personnel for operating the fire alarm system.

B. Provide hands-on demonstrations of operation of fire alarm system components and functions.

END OF SECTION

SECTION 31 11 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:

1. Provide all material, labor, equipment, and services necessary to completely clear and demolish all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. RELATED SECTIONS:

1. CONTRACT GENERAL CONDITIONS AND DIVISION 1, GENERAL REQUIREMENTS.
2. 31 20 00 EARTHWORK: EXCAVATION, FILLING, AND GRADING
3. 31 22 22 SOIL MATERIALS
4. 31 23 33 TRENCH EXCAVATION AND BACKFILL

1.3 SUBMITTALS

(NOT APPLICABLE)

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. In accordance with Specification Section GENERAL REQUIREMENTS, and the following:

a. Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].

B. Meetings:

1. Minimum agenda shall be to discuss coordination of upcoming work, review the work progress, discuss field observations, identification of any potential problems which may impede planned progress; corrective measures to regain projected schedule; and maintenance of quality and work standards.
2. Meetings shall include Pre-Clearing and Demolition Meetings.

3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:

    a. Contractor.
    b. Owner.
    c. Architect.
    d. Testing Laboratory.
    e. Local Governing Authorities as applicable.
    f. Utility Representatives as applicable.
    g. Owner's Inspector.
    h. Clearing and Demolition Subcontractor.
    i. Other subcontractors, as appropriate (including any accessory subcontractors).

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

A. Dust Control

1. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
2. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
3. No construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan, if one is required.
4. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.
5. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefor.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives, walks or occupied facilities.

    a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authorities having jurisdiction.
    b. Provide alternate routes around closed or obstructed traffic ways if required by Authorities having jurisdiction.

3. Locate and identify utilities.

    a. Call a Local Utility Locator Service (USA – "Underground Service Alert" – [800] 227-2600) for the task of locating any applicable utilities in the area where the Project is located.

4. Carefully remove items indicated to be salvaged and store on Owner's premises at the Owner's direction.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:

1. Protect and maintain all benchmarks and survey control points from disturbance during clearing and demolition operations.
2. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties.
3. Furnish and install temporary protection/barrier fencing surrounding the limits of demolition.
4. Protect trees, plant growth, and features not specifically designated for removal. Locate and clearly flag trees and vegetation to remain or to be relocated.
5. Protect existing improvements designated to remain from damage during construction.

    a. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.2 CONSTRUCTION

A. Shrub and Weed Removal:

1. Remove weeds and rooted topsoil to a minimum four (4) inch depth and temporarily stockpile as needed for re-use in finished grading of landscape areas. Remove excess material from the site.
2. Where existing vegetation is to be replaced by new materials, remove contaminated or excess soil from the site and legally dispose of off-site.

B. Existing Site Improvements Removal:

1. Remove existing above and below grade improvements as necessary to facilitate new construction.

a. Remove concrete slabs, sidewalk, curbs, mow strips, gutters, and fence post footings.

1) Neatly saw-cut length of existing pavement to remain before removing existing pavement unless existing full-depth joints coincide with line of demolition. Saw-cut faces vertically.

b. Remove indicated utility improvements within the limits of construction.

1) Excavate for and disconnect utilities designated to be removed. Seal or cap off underground.
2) Coordinate removal and/or relocation of utilities with the appropriate utility agencies.

c. Where existing underground utilities, irrigation pipes, wells, leach fields, or underground tanks are encountered, they must be removed or moved to a point at least 5 feet horizontally outside the proposed building and 3 feet horizontally outside the concrete flatwork or pavement construction areas. All resultant cavities must be backfilled with engineered fill.

C. Existing Utilities to Remain or be Relocated:

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

a. Notify Architect and the Owner not less than seven (7) days in advance of proposed utility interruptions.
b. Arrange to shut off indicated utilities with utility companies and Owner.

D. Disposal:

1. Legally dispose of all debris (surplus soil materials, unsuitable topsoil, obstructions, demolished materials, waste materials, trash, etc.) resulting from clearing, grubbing, demolition and from construction. Disposal of all materials shall be at a location secured by the Contractor off of the Owner's property.

END OF SECTION

SECTION 31 20 00 - EARTHWORK: EXCAVATION, FILLING AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:

1. Excavating soil and other material for surface improvements.
2. Placing fill.
3. Compaction of existing ground and fill.
4. Preparation of subgrade for other improvements.
5. Grading of soil.

B. RELATED SECTIONS

1. CONTRACT GENERAL CONDITIONS AND DIVISION 1, GENERAL REQUIREMENTS
2. 31 11 00 SITE CLEARING
3. 31 22 22 SOIL MATERIALS
4. 31 23 33 TRENCH EXCAVATION AND BACKFILL

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Product Data:

1. Information indicating the source of all import material, the fill material type and where it is to be used, and approval of the District's Inspector of Record for incorporation of import material into the Work.

B. Material Test Reports:

1. Classification of Soils.
2. Compaction Characteristics of Soils.
3. Density and Unit Weight of Soils in Place.
4. Imported fill shall be tested and approved by the Owner's Geotechnical Engineer prior to import to the site, including testing for compliance with Department of Toxic Substances Control (DTSC) guidelines. Said testing and certification documents shall be paid for by the Owner.

C. Project Closeout: In accordance with Specification Section PROJECT CLOSEOUT.

1. Drawings indicating the extent and depth of all engineered fill, and overexcavation and recompaction. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Installer:

1. Qualifications:

a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:

a.	CARB	Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
b.	CC	City of Clovis, Codes and Ordinances
c.	CF	City of Fresno, Codes and Ordinances
d.	EPA	Environmental Protection Agency.
e.	CAL/OSHA	Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable

regulations as they pertain to the protection of workers from the hazard of caving ground excavations.

f. DTSC — Comply with all recommendations of the California Department of Toxic Substance Control (DTSC) regarding soil testing for potential contaminants.

C. Certificates:

1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.
2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

1. Pre-Installation: Schedule prior to the start of work.

   a. Coordinate the work with other work being performed.
   b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress: Scheduled by the Contractor during the performance of the work.

   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.

   a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been filed.

1.7 COORDINATION

A. Coordinate work with Owner's personnel.

B. Provide required notification to the Owner and Geotechnical Engineer or the Engineer of Record so that a representative from the Owner's Geotechnical Engineering consultant can be present for all excavation, filling and grading operations to test and observe earthwork construction.

C. Verify that the location of existing utilities has been indicated at work site by utility authorities, by Owner, and as specified on the Plans.

1.8 EXISTING CONDITIONS

A. Existing Conditions:

1. Examine the site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
2. Thoroughly investigate and verify conditions under which the Work is to be performed.
3. Locate and identify utilities:

    a. Call a Local Utility Locator Service (USA - "Underground Service Alert" – [800] 227-2600) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.

4. No allowance for Extra Work will be granted resulting from negligence or failure to meet requirements of this Section.

B. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete flatwork, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunk line utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. Under similar circumstance, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

D. Determine exact location of existing buried utilities by:

1. Marking on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.
2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations and notify Owner of said request concurrently.
3. Confirm exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

E. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.

F. Provide Field Engineering to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under this Contract, submit detailed information to the Engineer for review and direction.

G. Maintain all existing utility mains and service lines in constant service during construction of the Work.

H. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work, and coordinate the timing of any such disruptions in advance with the District.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.

1. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.
2. All land clearing, demolition, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by pre-soaking.
3. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.
4. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.
5. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.

    a. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
    b. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. If required, Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
    c. If a dust control plan is required, no construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan.
    d. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.

e. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefore

B. Burning: No burning will be allowed on-site.

C. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.

D. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.

E. When reference is made to SWPPP (Storm Water Pollution Prevention Plan), if any within this Project Manual, then comply with all environmental protection requirements included therein.

F. In accordance with EPA, CARB, CF and CC.

G. Protection:

1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps. Provide dewatering as necessary.
2. Protect cut slopes from erosion due to precipitation and other sources of runoff.
3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Architect promptly for its review and action.
4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.

H. Before being brought onto the site, all import soil must be sampled, tested and approved by Owner's Geotechnical Engineer. All import material must comply with DTSC recommendations and guidelines for environmentally clean soil suitable for school construction. Import testing will be provided and paid for by the Owner.

1.10 PROJECT RECORD DOCUMENTS

A. Submit under provisions of GENERAL CONDITIONS and DIVISION 1, GENERAL REQUIREMENTS.

B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill in Turf or Other Planting Areas: Type S2 or S3 per Division 31 Specification Section SOIL MATERIALS.

B. Fill in Non-planting Areas: Type S1, S2 or S4 per Division 31 Specification Section SOIL MATERIALS.

C. Imported material: Type S3, S4 or S5 per Division 31 Specification Section SOIL MATERIALS.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Layout of Work:

1. Contractor shall be responsible for all lines and grades. Layout shall be provided by a California registered Land Surveyor or Civil Engineer, at Contractor's expense.
2. Check all benchmarks, monuments and property lines and verify locations.
3. Locate and maintain all grade stakes.
4. Monuments moved or displaced during grading operation are to be replaced by a California Registered Civil Engineer or Surveyor, at Contractor’s expense.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

D. Protect existing structures, fences, curbs, sidewalks, paving and other improvements to remain from damage from excavation equipment and vehicular traffic.

E. Employ equipment and methods appropriate to the work site.

F. Protect excavated areas from drainage inflow and provide for drainage of all excavated areas.

G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.3 SITE STRIPPING:

A. Reference is made to Division 31 Specification Section SITE CLEARING.

B. Within the areas of planned surface improvements and structures, the near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped and removed from the site. Upon approval of the Geotechnical Engineer, suitable materials stripped from the site may stockpiled and incorporated into the finish fill for planting areas.

C. All areas to receive surface improvements shall be stripped to remove turf, shrubs, trees and other vegetation, along with associated root systems, concrete, wood, metal, rubbish and other unsuitable debris, and any loose, saturated or unconsolidated soil material. Minimum stripping depth is expected to be 4-inches below existing site grades. Stripping shall continue to the depth required to expose acceptable basement soils that are free from deleterious which are not suitable for Engineered Fill, as required by the Geotechnical Engineer.

3.4 EXCAVATION

A. Following clearing and stripping operations, excavate planned construction areas as specified in this Section.

B. Provide additional excavation as required to conform to the lines, grades and cross-sections shown on the plans.

C. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw. Remove all roots ¼” in diameter and greater.

D. Remove excess soil not to be used as fill in the Work from the site. Unless requested by Owner to be deposited at a site designated by Owner on the property, obtain a disposal site and legally dispose of said excess material, all at no additional cost to the Owner.

E. Areas disturbed by demolition must be excavated to expose undisturbed soils.

F. Excavated soils free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 3% organic content by weight, may be returned to the excavations as Engineered Fill.

3.5 FILLING AND COMPACTING

A. Once clearing, stripping and over-excavation operations are complete, scarify the surface to receive fill material or improvements to a depth of 12-inches, moisture condition to at least 2% above optimum moisture content, and compact to a minimum of 92% of maximum dry density (relative compaction) based on ASTM Test Method 1557.

B. Place and compact soil to finish subgrade of improvements to be placed thereon, or to finished surface grade where no improvements are to be placed thereon.

C. All fill required shall be placed as Engineered Fill.

D. The Contractor shall be solely responsible for securing an acceptable source of import material as required to grade the site. Reference is made to 31 20 00 1.9.H

E. On-site soils are suitable for re-use as Engineered Fill, providing they are cleansed of excessive organics (less than 3 percent by weight, ASTM D2974), debris, and fragments larger than three (3) inches in maximum dimension and meet the requirements of soil Type S4, Division 31 Specification Section SOIL MATERIALS.

F. Engineered Fill shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557.
   1. Non-vegetative surface improvement areas (structures and site concrete improvements) - To a minimum of 92% of maximum dry density (relative compaction).
   2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density (relative compaction). Top twelve (12) inches - 85% of maximum dry density (relative compaction).
   3. Pavement areas: to a minimum 95% of maximum dry density (relative compaction) in top twelve (12) inches.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Additional lifts shall not be placed if the previous lift did not meet the required dry density (relative compaction), or if soil conditions are not stable.

I. Conform fill to the lines, grades and cross-sections shown on the plans.

J. Fill materials to conform to Division 31 Specification Section SOIL MATERIALS.

K. Provide, at no additional cost to Owner, imported soil material conforming to the requirements of Division 31 Specification Section SOIL MATERIALS, as needed to attain finished grades of Work.

L. Utilize equipment which will not disturb or damage existing utilities and other improvements.

3.6 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with this section.

B. Scarify the soil as specified and remove and dispose of (off the project site) all rocks, hardpan chunks or otherwise unsuitable material over 3-inches in size.

C. Thoroughly moisture condition and compact as described above.

D. Prior to commencing construction of surface improvements, pass a test roller of size and weight as approved by the Owner over the subgrade to establish the extent of soft or spongy areas requiring repairs.

E. Conform finished subgrade surface to the lines, grades and cross-sections shown on the plans.

3.7 FINE GRADING

A. Fine grade all finished surfaces to the lines, grades and cross-sections shown on the plans, and to blend to hard surface improvements.

B. Rake and smooth all finished surfaces not to receive hard surface improvements.

C. Use suitable stockpiled or imported topsoil for the top 12-inches of areas to receive landscape improvements.

D. Import topsoil meeting the requirements of Division 31 Specification Section SOIL MATERIALS, as required to complete finish grading.

E. Topsoil may not be used in areas requiring Engineered Fill.

3.8 TOLERANCES

A. Top surface of Subgrade for Non-Vegetative Surface Improvements or Layers thereof: Plus or minus 0.02 foot from planned elevation.

B. Top surface of Subgrade for Vegetative Surface Improvements or for Bare Ground - Plus or minus 0.05 foot of planned elevation, or as required for finish surface to match adjacent improvements or ground.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of GENERAL CONDITIONS and/or DIVISION 1, GENERAL REQUIREMENTS.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.

D. All retesting required as a result of failure of initial test will be performed by Owner's testing agency, at the expense of the Contractor.

3.10 PROTECTION

A. Protect graded areas from traffic, freezing, erosion, and all other sources of damage. Keep free of debris and trash.

B. Repair and re-establish grades to specified tolerances where completed or partially completed work becomes eroded, rutted, settled, or where it is damaged by subsequent construction operations or weather.

C. Where settlement occurs prior to acceptance of the work, remove and replace surface improvements, excavate, replace, and re-compact in accordance with these specifications, and restore the surface improvements.

3.11 CLEANING

A. Remove all surplus or unsatisfactory soil material, trash, and debris, and legally dispose of off of the Owner's property.

END OF SECTION

SECTION 31 22 22 - SOIL MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. SECTION INCLUDES
   1. Excavated (and re-used) materials and imported materials.

1.3 RELATED SECTIONS:

1. 31 20 00 EARTHWORK: EXCAVATION, FILLING AND GRADING
2. 31 23 33 TRENCH EXCAVATION AND BACKFILL

1.4 SUBMITTALS

A. Samples: Submit, in air-tight containers, 10 lb. sample of Type S3, S4 and S5 fill to inspector.

B. Soil Analysis: Submit for Type S3, S4 and S5 soils to be imported.

C. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.

D. For imported soil, obtain Geotechnical Engineer and District approval prior to importing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Soil Type S1: Excavated and re-used material, graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Soil Type S2: Excavated and reused material, graded; free of roots, lumps greater than one inch, rocks larger than 1/2 inch, debris, weeds and foreign matter.

C. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than ½ inch, debris, weeds, and foreign matter.

D. Soil Type S4: Imported borrow, suitable for purposes intended, meeting the following characteristics:

1. Maximum Particle Size: 3”
2. Percent Passing #4 Sieve: 65-100
3. Percent Passing #200 Sieve: 20-45
4. Expansion Index: <20
5. Plasticity Index: <12
6. R-Value (in paved areas): >50
7. Low Corrosion Potential:

    a. Soluble Sulfates: <1,500 mg/Kg
    b. Soluble Chlorides: <300 mg/Kg
    c. Soil Resistivity: >5,000 ohm-cm

E. Soil Type S5: Imported sand. Natural river or bank sand (sand equivalent greater than 30), washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.2 SOURCE QUALITY CONTROL

A. Inspection of imported soil will be performed by the Geotechnical Engineer, at source of import and prior to being delivered to the site.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile excavated or imported material onsite at location designated by project inspector.

B. Stockpile excavated or imported material in sufficient quantities to meet project schedule and requirements.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

B. Dispose of excess material off-site.

END OF SECTION

SECTION 31 23 33 - TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. SECTION INCLUDES
1. Excavating trenches, holes and pits for constructing the Work.
2. Backfill and compaction.
3. Providing suitable bedding and backfill material, as specified herein.

B. RELATED SECTIONS
1. CONTRACT GENERAL CONDITIONS AND DIVISION 1, GENERAL REQUIREMENTS
2. 31 11 00 SITE CLEARING
3. 31 20 00 EARTHWORK: EXCAVATION, FILLING AND GRADING
4. 31 22 22 SOIL MATERIALS

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Installer:

a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:

a.	CARB	Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
b.	CC	City of Clovis, Codes and Ordinances
c.	CF	City of Fresno, Codes and Ordinances
d.	EPA	Environmental Protection Agency.
e.	CAL/OSHA	Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.

C. Certificates:

1. Installer's certification that all trench backfill installation meets or exceeds the requirements of this specification.
2. Contractor's certification (on Contractor's letterhead paper) that the trench backfill materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

1. Pre-Installation: Schedule prior to the start of work.

a. Coordinate the work with other work being performed.
b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress: Scheduled by the Contractor during the performance of the work.

a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.

a. Inspect and identify any problems which may impede issuance of warranties or

guaranties.

4. Maintain installed work until the Notice of Substantial Completion has been filed.

1.6 COORDINATION

A. Coordinate work with Owner's personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

1.7 EXISTING UTILITIES

A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Under circumstance similar to 31 23 33/1.7A, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. Determine exact location of existing buried utilities by:

1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations, and notify Owner of said request concurrently.
3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

D. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.

E. Provide Field Engineering per Contract General Conditions and Division 1 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner's Inspector and Engineer for review and direction.

F. Maintain all existing utility mains and service lines in constant service during construction of the Work.

G. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill Type S1, S2, S4 and S5, as specified in Division 31 Specification Section SOIL MATERIALS.

2.2 WARNING TAPE

A. 6” wide warning tape shall be installed over all of the pipelines as shown on the details.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.

C. Maintain and protect above and below grade utilities which are to remain.

D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.2 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.

C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.

D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.

E. Do not interfere with 45 degree bearing splay of foundations.

F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.

G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings, and then backfill to the pipe grade with Type S2, S4 or S5 material, containing sufficient moisture to allow compaction to 92% relative compaction. No additional payment will be made for such over-excavation and refill.

H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Type S2, S4 or S5 material containing sufficient moisture to allow compaction to 90% relative compaction. No additional payment will be made for such additional excavation or backfill.

I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.

J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.

K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.

L. Remove excess soil not used as backfill from the work site. Obtain a disposal site off of the Owner's property and legally dispose of said excess material, all at no additional cost to the Owner.

M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.

N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

3.3 PROTECTION OF EXCAVATIONS

A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.

B. Prevent water, caving or sloughing ground from entering excavations.

C. Maintain excavations free of water.

3.4 BACKFILLING

A. Provide type S2 or S5 pipe bedding as required by Plans and compact to 90% relative compaction.

B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements

C. Backfill trenches above pipe bedding material and to within 24 inches of finish subgrade with Type S1, S2, S4 or S5 soils, except that that top 12 inches shall be type S2, S3, S4 or S5 soils.

D. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.

E. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to at least 3% above optimum moisture content.

F. Maintain optimum moisture content of fill materials to attain required compaction.

G. Backfill final 12-inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type S2, S4 or S5 soils.

H. Backfill final 12-inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil, with Type S2 or S3 soils.

I. Compact backfill below the top 12-inches to 90% relative compaction.

J. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% relative compaction.

K. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% relative compaction.

L. In planting areas, compact the top 12-inches to 85% relative compaction.

3.5 TOLERANCES

A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.

B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 1.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

3.7 PROGRESS AND PROSECUTION

A. Backfill any excavation opened in any day on that same day.

END OF SECTION

SECTION 32 01 90 - EXISTING LANDSCAPE PROTECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes but is not limited to the following:
   1. Protection and maintenance of existing trees and other plants that are affected by the execution of the Work, whether temporary or new construction.
   2. Boxing, moving, maintaining and replanting existing trees scheduled to be relocated.

B. Related Work Specified Elsewhere
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections.
   2. Section 31 11 00: Site Clearing
   3. Section 31 20 00: Earthwork
   4. Section 31 23 33: Trench Excavation and Backfill
   5. Section 32 84 00: Irrigation System
   6. Section 32 90 00: Landscape Planting

1.2 SUBMITTALS

A. Product Data: For each type of product indicated or proposed for use.

B. Qualification Data: Submit arborist's certification and/or license information. Submit qualifications and experience of the certified tree worker if not the arborist.

C. Project Certification: Provide a certification letter from the consulting arborist that trees indicated to remain have been protected during construction according to these specifications and/or the arborist's recommendations, and provide a list of any trees damaged during construction and the subsequent treatment and repair.

D. Transplanting and Maintenance Recommendations: Submit transplanting, maintenance and protection specifications from a qualified arborist for care and protection of trees during and after completion of the Work that are likely to be affected by construction operations. The tree maintenance recommendations shall be included in the Maintenance Manuals required in 329000.

E. Tree Assessment and Valuation: Prior to the start of any construction operations of any kind, submit a tree assessment including tree valuation for existing trees scheduled to remain in the area of work or in auxiliary construction areas.
   1. Tree valuation for trees species that do not have comparable and available replacement sizes shall be determined by a certified consulting arborist experienced in tree valuation using the "Guide for Establishing Values of Trees and Other Plants", current edition, published by the International Society of Arboriculture, Urbana, Illinois.
   2. Tree assessment shall include a physical description, health, condition and recommended pruning and/or mitigation measures based on the expected construction operations to minimize the negative impacts to the affected trees.

1.3 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and/or relocation work similar to that required for this Project, and who will provide experienced, certified tree workers.

B. Arborist Qualifications: The arborist shall be certified by the International Society of Arboriculture. If the arborist is performing tree work, he/she shall be employed by a licensed contractor, or shall hold an individual license if independent.

C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated or recommended by the certified arborist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: See Section 32 93 00.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers, minimum 4.8 oz/sq. yd.

D. Temporary Fencing: Heavy-duty exterior rated plastic or chain link fencing, minimum four feet high with stakes at a maximum 10 feet on-center or as needed for a taut installation.

E. Wood mulch: Walk-on type chipped wood and aged greenwaste material without leaves, green wood, sticks, dirt, dust, construction materials and other debris. Particle size 1/2” to 3" in general size.

F. Coarse sand: Clean sand with greater than 95% passing a #10 seive, less than 5% passing a #30 seive, and less than 1% passing a #50 seive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing located around the canopy drip line of trees (the tree protection zone [TPZ]), and around the plants scheduled to remain that are inside the construction area. The TPZ fence layout shall be reviewed for acceptance by the Owners Representative and the consulting arborist.

B. All work within the TPZ shall be reviewed and monitored by the consulting arborist.

C. Within the TPZ, install a 4 inch depth of wood mulch over a permeable filter fabric with minimum 4 inch overlaps at fabric seams. Remove the protection mulch and fabric prior to any cultivation and amendment tillage.

D. Provide a temporary dirt berm watering basin around trees and plants scheduled to remain. The berm around trees shall be a minimum diameter of six times (6x) the diameter of the tree at breast height (DBH), or not less than six feet in diameter, whichever is greater.

E. Provide temporary irrigation or a portable water source to irrigate trees and plants scheduled to remain. Irrigate at minimum once a week or more often as necessary to moisten soil to a minimum 18 inch depth for trees, and a minimum depth of 12 inches for shrubs. Reapply irrigation based on an evapotranspiration loss of 50%.

F. Protect plant/tree root systems within the protected fenced areas from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

G. Do not store construction materials, debris, or excavated material within the TPZ. Do not permit vehicles or reoccuring foot traffic within the TPZ to prevent soil compaction over root systems.

H. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Do not excavate within the canopy drip line of existing trees unless otherwise authorized. Any excavation within the TPZ shall be performed under the onsite monitoring by the consulting arborist.

B. Where excavation for new construction and/or utility lines are required within the canopy drip line of trees, hand clear and excavate to minimize damage to root systems. Use spading forks to comb soil or use an Air-Spade to expose roots.

C. Where utility lines are to be located within the drip line of trees, expose the existing root system to the depth of utility line installation plus the depth of any required bedding material. Place piping below and/or through the exposed roots without damage to the root system. Backfill with approved material and compact by flooding the area if allowed.

D. As an alternative to manual or Air-Spade trench excavation, utility or other below grade piping may be mechanically bored under the crown dripline with a minimum cover of 3 feet as authorized by the consulting arborist.

E. Root Pruning: Do not cut main lateral roots or taproots greater than one inch in diameter. Smaller roots less than one inch in diameter that interferes with the installation of new improvements and/or utility lines may be cut only if absolutely necessary. Only cut roots with sharp pruning instruments; do not break, tear or chop. Block out concrete footings around roots greater than one inch diameter leaving a minimum one inch clearance around roots to remain. Provide alternative footing design if main lateral roots are in conflict.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by the certified arborist, unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots less than one inch diameter. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 12 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations. Do not place fill greater than 6 inches in depth within 24 inches of the trunk, and do not cover the trunk/root base flare. Do not allow standing water at the trunk.

C. Moderate Fill: Where existing grade is more than 12 inches , but less than 18 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
   1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of existing grade and extend not less than 20 inches from tree trunk on all sides up to the finish grade. Slope of the rock fill shall be a maximum 2h:1v. For balance of area within drip-line perimeter, place drainage fill a minimum 6 inches in depth.
   2. Place filter fabric over the drainage fill with edges overlapping 6 inches minimum.
   3. Place fill layer of topsoil to finish grade. Do not mechanically compact drainage fill or topsoil more than 85% relative density in planted areas. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction only when authorized by the Landscape Architect and as recommended by the consulting arborist.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system only when authorized by the Landscape Architect and as recommended by the consulting arborist. Provide subsequent maintenance during Contract period as recommended by the consulting arborist.

C. Pruning Standards: Prune trees according to ANSI A300 based on pruning for access clearance, to correct any defects in structure, or to remove potential conflicts with new improvements. Pruning shall only be performed by a Certified arborist or tree worker.

D. Cut branches with sharp pruning instruments; do not break or chop. Clean pruning tools with a diluted bleach solution prior to performing any pruning operations.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the arborist.

B. Remove and replace dead and/or damaged trees impacted by the construction operations that the arborist determines to be incapable of restoring to a normal growth pattern.

1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in 32 90 00.
2. When new trees of the same size and species are not available, furnish and install the largest size boxed tree that is readily available and will successfully grow in the planting area with long term health and without damage to adjacent improvements. Credit the Owner the difference between the valuation of the removed existing tree and the installed replacement tree.

C. Aerate surface soil within any existing Oak tree dripline compacted before or during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 18 inches deep at 36 inches o.c. Backfill holes with coarse sand. Manually till the top 4 inches with a spading fork, and break up clods greater than 1 inch diameter. Smooth grade prior to installing wood mulch.

3.6 TRANSPLANTING TREES FOR RELOCATION

A. Preparation

1. Follow the transplanting recommendations of the consulting arborist and these specifications. If conflicting directions are present, notify the Landscape Architect for a resolution. If no notice if given, follow the most strict and/or costly option.
2. A light thinning of the tree canopy shall be performed prior to boxing to reduce the leaf area by approximately 10 – 15 percent, and to remove any dead wood. Pruning shall be performed under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).
3. Surrounding pavement shall be sawcut and removed as needed for boxing operations.
4. Ensure adequate soil moisture around the rootball so that no soil breaks away from the rootball during side boxing operations.

B. Boxing

1. The box dimensions shall be a square of a minimum of 6 times the diameter (caliper) of the tree trunk at 12 inches above the existing grade. In all cases, the box dimension shall not be less than 24 inches.
2. Excavate by hand around the sides of the tree for the top 12 inches of soil, or until the majority of the lateral roots have been severed. Rough excavate by machine to the required depth. Final rootball shaping shall be performed by hand. All root pruning shall be cut clean and square with pruning loppers or pruning saw. Treat all severed root ends with a antidesiccant to diminish root transpiration.
3. The box sides shall be securely fastened with horizontal metal bands, and all voids filled. Following side boxing, the tree shall remain in place a minimum of 4 weeks. Provide a minimum 3 inch depth of wood mulch on the top surface of the box. Maintain adequate soil moisture in the rootball.
4. After the acclimation period, the tree shall be undercut and bottom boxed. Securely fasten the bottom panel with vertical metal bands running on all four sides of the box. Secure the crane cable around and/or under the tree box in order to lift the tree out of the ground. The Contractor is responsible to ensure the box is constructed to withstand the weight of the watered tree and the stress of moving.
5. The relocated trees shall be moved with equipment rated for the size and weight of the boxed tree. The Contractor is responsible for all expenses related to the moving, storage, planting and maintenance of the relocated tree.

6. The void of the removed tree shall be backfilled with one of the following:
    a. Engineered fill per the Earthwork specification in a proposed hardscape area, or area underneath structures.
    b. Planting topsoil per the Landscape Planting specification in a proposed planting area.

C. Maintenance and Replanting
1. If necessary, temporarily store the tree out of the immediate construction zone but inside the construction fenced area. Provide a temporary irrigation source and a regular irrigation schedule.
2. Prepare the new planting pit and plant the tree per the approved planting detail and specifications. Maintain the watering berm for as long as possible when in a turfgrass area.

3.7 CLEAN-UP

A. Burning is not permitted.

B. Prior to Final Acceptance, remove the TPZ fence, stakes and other related materials.

C. Legally remove excess excavated material, debris, displaced trees, and greenwaste from Owner's property. Broom clean all hardscape surfaces in the area of work.

END OF SECTION

SECTION 32 11 26 - AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to install aggregate base surfacing as indicated by the Contract Documents.

1.3 RELATED SECTIONS

A. All Division 00 Specification Sections
B. All Division 01 Specification Sections
C. 31 20 00 EARTHWORK
D. 31 23 33 TRENCH EXCAVATION AND BACKFILL
E. 32 13 13 SITE CONCRETE IMPROVEMENTS

1.4 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials

1.5 QUALITY ASSURANCE

A. Provide and install in accordance with SSCDOT.

1.6 SUBMITTALS

A. Submit data sheets from supplier to document compliance with SSCDOT requirements.

B. Certificates of compliance for material.

C. Load tags for delivered material.

1.7 COORDINATION

A. Coordinate with other work, including subgrade preparation and soil sterilization.

B. Coordinate installation schedule with Owner's use of the premises and with other contractors working at the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Base: Unless specified otherwise on Plans, Class 2, 3/4 Inch Maximum per Section 26 of SSCDOT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify quantities required.

B. Verify that subgrade has been placed and compacted per Contract Documents

C. Verify gradients and elevations of subgrade are correct.

3.2 INSTALLATION OF AGGREGATE BASE COURSE

A. Install in conformance with SSCDOT Section 26, Aggregate Bases.

B. Thickness - As shown on construction drawings.

C. Spreading and Compacting - In accordance with Section 26, SSCDOT. Base course shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557. The relative compaction of each layer of compacted base material shall be not less than 95 percent.

D. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities, true to grade and cross-section.

E. Lines and grades for the installation of aggregate base shall be set by a California licensed Land Surveyor or Civil Engineer, at Contractor's expense.

3.3 TOLERANCES

A. Compacted thickness of aggregate base: Not less than the thickness specified on the Plans.

B. Finished Surface: Within 0.02 foot of planned grade per Section 26, SSCDOT. No more than 50% of the finish surface shall be above or below the specified grade for aggregate base.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by the Owner's inspector, under provisions of Division 01.

3.5 PROTECTION

A. Immediately after placement and compaction, protect surface from mechanical injury.

B. Protect completed surface until surfacing layers are in place.

END OF SECTION

SECTION 32 12 16 - SOIL STERILIZATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work specified in this section.

1.2 SECTION INCLUDES

A. Furnishing and installing soil sterilant under all new crushed stone surfacing (decomposed granite and rock dust).

1.3 RELATED SECTIONS

A. 31 20 00 EARTHWORK: EXCAVATION, FILLING, AND GRADING
B. 31 23 33 TRENCH EXCAVATION AND BACKFILL
C. DRAWINGS AND GENERAL PROVISIONS OF CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION-1 SPECIFICATIONS SECTIONS, APPLY TO THE WORK OF THIS SECTION.

1.4 STANDARDS

A. In accordance with the following:

CCR-T21	California Code of Regulations, Title 21 Public Works.
CBC	California Building Code, California Code of Regulations, Title 24, Part 2, CCR-T24.
USDA	United States Department of Agriculture.
EPA	Environmental Protection Agency.
CC	City of Clovis
CF	City of Fresno

All applicable Environmental Regulations and Standards.

1.5 QUALITY ASSURANCE

A. Provide licensed operator to apply soil sterilant.

B. All products shall comply with the current EPA laws at time of application. Should the products listed become unavailable because of changes in the law, submit substitute products for review by the Owner.

1.6 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTAL PROCEDURES.

B. Certificates of application.

C. Certificates of compliance for material.

1.7 COORDINATION

A. Coordinate with other work, including subgrade preparation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soil Sterilant: Oust, weed and grass preventer, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site is ready for application.

3.2 PREPARATION

A. Identify installation locations.

B. Employ equipment and methods appropriate to the work site.

3.3 APPLICATION

A. Thoroughly water soak surface to be treated. Avoid excessive water runoff.

B. Apply sterilant solution over surface to receive pavement or surfacing prior to the start of pavement or surfacing installation.

C. Apply in spray form, at rate as allowable by State of California and the manufacturer's recommended application rate.

D. Take all precautions to limit soil sterilant solution to areas immediately under proposed pavement or surfacing. Use shields as necessary, and do not apply under windy conditions.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under Specification Section QUALITY REQUIREMENTS.

END OF SECTION

SECTION 32 13 13 - SITE CONCRETE IMPROVEMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. All material, labor, equipment and services necessary to completely install exterior Portland cement flatwork, cast-in-place concrete, and architectural flatwork concrete, accessories and other related items, slabs, ramps and sidewalks and walkways, curb and gutter, mowstrips, and other miscellaneous concrete items of the form and dimensions shown on the plans and necessary to complete the project, and in accordance with the requirements of the Standard Specifications as modified and supplemented by these Special Provisions
   2. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

B. RELATED SECTIONS:
   1. 31 20 00 EARTHWORK: EXCAVATION, FILLING, AND GRADING

1.3 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

B. ACI standards, including but not limited to #304, 305, 306, 308, 309 and 347.

C. ASTM standards, including but not limited to #C-33, C-39, C-94, C-136, C-143, C-150, and C-309.

1.4 SUBMITTALS

A. Submit under provisions of Specification Section SUBMITTALS.
   1. Certificates of compliance for materials and mix designs.
   2. Load tags for delivered material.
   3. Strength testing as required by the approving agency.
   4. Integral color sample, where applicable.
   5. Application instructions for the architectural finish materials.
   6. Accessories and manufacturer’s installation specifications.

1.5 QUALITY ASSURANCE

A. Furnish concrete materials conforming with SSCDOT.

B. Perform work in accordance with SSCDOT, unless noted otherwise herein.

PART 2 - PRODUCTS

2.1 MIXES

A. Mix Design and Proportions in accordance with SSCDOT:
   1. Mix designs with Fly Ash content no greater than 15 percent of the total weight of cementitious materials shall be proportioned by SSCDOT.
   2. Provide a maximum of 4 percent air entrainment, unless noted otherwise.
   3. Owners Testing laboratory shall review all mix designs before submittal.
   4. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 and SSCDOT at 28 days and shall be proportioned within the following limits:
      a. Site Concrete: Use for exterior concrete slabs on grade including, but not limited to sidewalks, curbs, gutters, mow strips, utility appurtenances and miscellaneous site improvements.
         1) Strength: 3,000 psi at 28 days
         2) Maximum Aggregate Size: 1-inch
         3) Cement Content: 5.5 sacks/yd minimum
         4) Max Water/Cement Ratio: Per SSCDOT
         5) Admixture Per SSCDOT
      b. Structures & Vehicular Concrete Paving: Use for site structures and exterior slabs on grade subject to vehicle traffic.
         1) Strength: 4,000 psi at 28 days
         2) Maximum Aggregate Size: 1-inch
         3) Cement Content: 6.5 sacks/yd minimum
         4) Max Water/Cement Ratio: Per SSCDOT
         5) Admixture: Per SSCDOT
      c. Slurry Backfill: Use for backfill of over-excavated trenches, encasement of all penetration, and site utility piping.
         1) Maximum Aggregate Size: 3/8-inch
         2) Cement Content: 2.0 sacks/yd minimum

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade shall conform to the requirements of Division 31 Specification Section EARTHWORK: EXCAVATION, FILLING AND GRADING. The District may elect to verify compacted subgrade elevations by measurement made from adjacent existing improvements or by a template supported by forms.

3.2 GENERAL CONCRETE

A. Concrete placement shall conform to the applicable requirements of Standard Specification Sections 51 and 90. Concrete shall not be placed when the air temperature in the shade at the project site exceeds 95º F or is below 45º F, or when the temperature of the concrete exceeds 85º F.

B. After the concrete has been placed, it shall be struck off to proper section and compacted with a grid of parallel metal bars until a layer of mortar not less than 3/8 inch thick has been brought to the surface. All exposed concrete surfaces shall receive a medium broom finish applied transversely to the line of pedestrian traffic or to the longest dimension of the concrete, as applicable.

C. General concrete surfaces shall be cured by the curing compound method and shall be protected in accordance with the provisions of Subsections 90-1 and 90-2 of the Standard Specifications.

3.3 PROTECTION OF CONCRETE

A. The Contractor shall be responsible for the condition of all concrete work until such time as all work has been completed and is accepted by the District. The Contractor shall limit vehicular travel across concrete until such time as the concrete has achieved strength sufficient that it can support traffic without damage. In no case, however, will vehicles be allowed to travel across new concrete improvements until seven calendar days have passed since the concrete was placed.

3.4 CONCRETE JOINTS

A. Expansion joints and weakened plane joints shall be constructed at the locations shown on the plans or as directed by the Engineer. Where joint locations are not specified on the plans, expansion joints shall be constructed at maximum intervals of 30 feet and weakened plane joints shall be constructed at maximum intervals of 10 feet.

B. Expansion joints shall be considered as weakened plane joints for the purpose of spacing weakened plane joints. Expansion joints shall be tooled with a 1/4 inch maximum radius edger, and shall be filled with 3/8 inch pre-formed expansion joint filler.

3.5 CONCRETE FINISHES

A. Where concrete is being installed adjacent to or near existing concrete improvements, match the finish of similar concrete surfaces (i.e. new sidewalks shall match existing sidewalks, new curbs shall match existing curbs, etc.).

B. Sidewalks and Mowstrips: Medium sweat finish or medium broom finish perpendicular to the direction of travel.

C. Curbs: Trowel smooth and finish with a light brush.

D. Gutters: Medium broom finish parallel with curb or direction of flow.

E. Drive approaches and wheelchair ramps: medium broom finish, perpendicular to the direction of travel.

3.6 INSTALLATION OF ACCESSORIES

A. Strictly comply with manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

3.7 REPAIR AND CLEAN-UP

A. Contractor shall legally remove all trash, debris, containers and excess materials from the site on a periodic basis, and shall keep the work broom clean until Owner’s acceptance.

B. The Contractor shall be held responsible for the repair and/or replacement of new or existing improvements damaged as a result of this work to the satisfaction of the Owner.

C. The Contractor shall provide roll-off bins for wash-out of ready mix concrete trucks and pumpers. Do not allow concrete debris or cement water onto soils scheduled for landscape planting.

END OF SECTION

SECTION 32 15 40 - CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install decomposed granite surfacing which includes:
   1. Sub-grade Preparation
   2. Base Preparation
   3. Edge restraint
   4. Stabilizer
   5. Compaction
   6. Cleanup

B. Related Sections:
   1. 31 22 00 EARTHWORK
   2. 31 22 22 SOIL MATERIALS
   3. 32 11 26 AGGREGATE BASE

C. Definitions: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 SUBMITTALS:

A. Procedure: Submittals shall be provided in accordance with Division 1 requirements.

B. Submit aggregate sieve analysis, product specifications and a one pint representative sample of the proposed decomposed granite, with named source.

PART 2 - PRODUCTS

2.1 DECOMPOSED GRANITE

A. Decomposed granite is referred to by the abbreviation (D.G.), or referred to as disintegrated granite. All decomposed granite for non-vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
3/8 inch	100
No. 4	90-100
No. 8	75-80
No. 16	55-65

Sieve Designation	% Passing
No. 30	40-50
No. 50	25-35
No. 100	15-20
No. 200	10-15

B. All decomposed granite for vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
1/2 inch	95-100
3/8 inch	90-95
No. 4	65-80
No. 8	43-63
No. 16	40-49

Sieve Designation	% Passing
No. 30	30-40
No. 50	20-27
No. 100	10-18
No. 200	10-12

C. The portion of D.G retained on the no. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96.

D. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and maximum plasticity index of 7 as determined by AASHTO T89 and AASHTO T90, respectively.

E. The sand equivalent shall be in the range of 35-55. The R-value shall be a minimum of 71.

F. Crushed aggregate screenings shall be free from clay lumps, vegetative matter and deleterious material.

G. D.G. shall be tan in color.

2.2 SOIL BINDER

A. Binder shall be a non-toxic, colorless, odorless, organic powder that binds D.G. screenings consisting of 95% Psyllium with a minimum 70% Mucilliod content. The binder shall be "Stabilizer" as manufactured by Stabilizer Solutions Inc., (800) 336-2468, FAX: (602) 225-5902, or equal.

2.3 EDGING

A. Aluminum edging: 3/16" x 5 ½", manufactured from 6063 extruded aluminum alloy of T-6 hardness with interlock system and 5 stake punch outs fabricated in each strip. Stakes 12" long, lock 1/2" below top of edging.
   1. Finish: Black anodized

PART 3 - EXECUTION

3.1 SUBGRADE AND DECOMPOSED GRANITE PREPARATION AND COMPACTION

A. Subgrade under all D.G. shall be scarified to a minimum depth of 12", graded and compacted to 90% relative compaction.

B. Aggregate base under D.G. surfacing shall be in conformance with Section.

C. After subgrade preparation or base installation, sterilize base or subgrade receiving D.G. surfacing per Section 321216.

D. Minimum compaction for pedestrian use D.G. surfaces shall be 85% relative density, and 90% relative density for vehicular use. The Contractor shall provide one compaction test for every 2,000 square feet or fraction thereof.

E. The finish grade shall be even between the headers with no humps or depressions greater than +/- 0.25" after the compaction.

3.2 SOIL STABILIZER AND DECOMPOSED GRANITE INSTALLATION

A. Soil stabilizer shall be thoroughly mechanically blended per the manufacturer's recommendations with the D.G. screenings prior to transport to the job site.
   1. For vehicular and/or pedestrian use, the stabilizer shall be mixed at a minimum rate of 15 lbs. of Stabilizer product per ton of D.G. aggregate.
   2. For tree well use, the stabilizer shall be mixed at a minimum rate of 8 lbs. of Stabilizer product per ton of DG aggregate.
   3. Premixed Stabilizer and D.G. material can be obtained locally by contacting the stabilizer manufacturer and obtaining the location of a local vendor.
   4. Drop spreading of the Stabilizer product over raked D.G. screenings and mixing stabilizer by rototilling is NOT ACCEPTABLE.

B. Place the premixed stabilizer product on the pre-soaked subgrade in maximum 2" lifts. Rake smooth to the desired grade and cross slope.

C. After placement and raking, water the Stabilized D.G. to achieve full depth moisture penetration of the placed product. Apply 25 – 45 gallons per ton to achieve the proper full depth moisture penetration.

D. After 6 – 72 hours for activation, roll the Stabilized D.G material with a 2 to 5 ton double drum roller to achieve finish grade and initial compaction without separation, plowing or any other physical compromise of the aggregate. Utilize a hand tamp at edges, around benches, and sign posts. Do not use a vibratory wacker plate or vibratory roller to compact the Stabilized D.G.

E. Finish surface elevation:
   1. Compacted finish surface of DG shall be flush with headers, paving, mowstrips and/or curbs, unless otherwise indicated.
   2. Compacted finish surface of DG shall be two inches above finish grade in adjacent shrub/ground cover planting areas, unless otherwise indicated.
   3. Compacted finish surface of DG shall be one-half inch above finish grade in adjacent sodded turfgrass planting areas, unless otherwise indicated.
   4. Compacted finish surface of DG shall be flush to finish grade in adjacent seeded or sprigged turfgrass planting areas, unless otherwise indicated.

F. Lightly spray the surface after compaction operations. Allow the finished surfce sufficient time to dry prior to use.

G. Finished surface shall be smooth, uniform and solid with no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose

material shall not be present on surface after installation, but may appear after use and according to environmental conditions. Pathway shall remain stable underneath loose granite on top with a “natural” look. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.3 CLEANUP

A. After all stabilization operations are completed, remove trash, excess materials, empty containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

B. The D.G. surface shall be dragged and a final dressing performed within 48 hours prior to final acceptance.

END OF SECTION

SECTION 32 31 13 – CHAIN LINK FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Provisions of constructing chain link fence at locations shown on the Construction Documents, including but not limited to:
   a. Site chain link fencing and gates.

B. RELATED SECTIONS

1. CONTRACT GENERAL CONDITIONS AND DIVISION 1 SPECIFICATIONS
2. 31 20 00 EARTHWORK: EXCAVATION, FILLING, AND GRADING
3. 32 13 13 SITE CONCRETE IMPROVEMENTS

1.2 QUALITY ASSURANCE

A. Qualifications of Installer

1. Throughout the progress of installation of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.
2. In actual installation of the work of this Section, use adequate numbers of skilled workmen to insure installation in strict accordance with the contract documents.
3. In acceptance or rejection of work performed under this Section, the Engineer will make no allowance for lack of skill on the part of the workmen.

1.3 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the work of other trades.

B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The materials and fabrication of chain link fabric shall conform to these specifications, and as shown on the plans and details.

B. All ferrous materials shall be new and galvanized. Imperfectly galvanized material or material upon which serious abrasions of the galvanizing occur shall not be used.

C. Height - all fencing shall stand at the heights shown on the plans.

D. Fabric

1. Standard: Chain link fabric shall conform to ASTM, designation: A392, Class 1. The wire used in the manufacture of the fabric shall be 9-gauge. All chain link fabric shall be woven into approximately 2-inch mesh. Fabric shall be furnished with knuckling at all selvages. The knuckled selvage shall be used along all corners and edges. Fabric shall be GBW, galvanized before weaving.

E. Posts, braces and gate frames

1. The base material for the manufacture of steel pipe used for posts and braces shall conform to the specifications of ASTM, designation: A53 Type A, standard weight, Schedule 40, and the base material for the manufacture of other steel sections used for posts and braces shall be good commercial quality weldable steel.
2. All posts, braces and gate frames shall conform to the size and weight designations shown on the plans.
3. All posts shall be fitted with rainproof caps designed so as to fit securely over the top of the posts.
4. All posts shall be of a total length of not less than the depth of the concrete footing as shown on the plans, plus the length required above ground.
5. Posts and braces shall be galvanized in accordance with specifications of ASTM, designation: A123.
6. All horizontal braces shall be attached to posts by approved steel fixtures.

F. Stretcher bars and other required fittings and hardware shall be steel and shall be galvanized in accordance with the specifications of ASTM, designation: A153.

G. All swinging gates and walk gates shall be installed with a gate holdback, Trimco 1209HOHA-626. Holdbacks shall be installed in the concrete mowstrip, unless otherwise noted.

H. Concrete mowstrip shall be in accordance with Section 321313 SITE CONCRETE IMPROVEMENTS.

I. Walk gates shall be constructed as per detail drawing and in accordance with CBC sections 11B-206.5 and 11B-404.

J. Walk gate shall be constructed as per detail drawing.

K. Non-accessible swinging gates shall comply with the following:

1. Have a lockable fork latch.
2. Have heavy-duty malleable iron hinges

PART 3 - EXECUTION

3.1 INSTALLATION

A. All posts shall be set in concrete footings as shown on the plans to within 3 inches of bottom.

B. All vertical line and end posts shall be braced to the nearest adjacent vertical post with galvanized horizontal braces as shown on the plans.

C. Welding

1. All welding shall conform to the requirements of the Uniform Building Code, UBC, Chapter 22.
2. Where the galvanized surface has been burned by welding, all surfaces of the welded connections shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed. The damaged area and weld shall then be painted in accordance with the following details.
   a. All galvanized, welded, or damaged surfaces that are to be painted shall first be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.
   b. After washing, all areas shall be roughened by abrasive blasting using an abrasive that is no larger than 30-mesh. Galvanizing shall not be removed by this operation.
   c. After preparation, all galvanized surfaces that are to be painted shall be covered with one application of zinc dust-zinc oxide primer, federal specification TT-P-641, Type II. The zinc dust-zinc oxide paint shall be applied by spraying to produce a complete covering of the galvanized surface.
   d. After the application of the zinc dust-zinc oxide paint, one application of pre-treatment, vinyl wash primer, Section 91-2.7 of the state Standard Specifications, shall be applied to such surfaces. The vinyl wash primer shall be applied by spraying to produce a uniform wet film on the surface.
   e. Such surfaces shall then be covered with two separate applications of white tint base vinyl finish coat, Section 91-2.22 of the state standard specifications, sufficient to completely cover the preceding color. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the second application. After drying for 24 hours, one application of aluminum paint, finish coat, Section 91-2.8 of the state standard specifications, shall be painted on the welded areas.

D. Perimeter fencing chain link fabric shall be fastened to the outside of the fence.

E. All fabric shall be stretched and securely fastened to the posts, as follows:

F. The fabric shall be fastened to end, corner and gate posts with 3/16 inch by 5/8 inch stretcher bars and not less than 1/8 inch by 3/4 inch stretcher bar bands spaced at one foot intervals for

whatever widths of fabric are supplied. The fabric shall be fastened to line posts with tie wires or post clips. Tie wires shall be at least 9-gauge (0.148 inch diameter) steel. Post clips shall be at least 6-gauge (0.192 inch diameter) steel. The wire or clip fasteners shall be spaced at approximately 14 inches on line posts, with a minimum of 5 fasteners per 6 foot high post. Top and bottom edges of the fabric shall be secured to each horizontal brace with tie wires or fastened to tension wire with hog rings spaced at 15 inch maximum intervals. Hog rings shall be at least 9-gauge (0.148 inch diameter) steel. Wire ties shall be given at least one complete turn. Hog rings shall be closed with ends overlapping. The distance from the selvage to the braces or top rails shall be 2 inch maximum and shall be fastened to the brace or rail by wire fasteners spaced at approximately 14 inches with a minimum of 8 fasteners per each 10 foot horizontal span.

G. Construct concrete mowstrip at the width as shown on the plans.

END OF SECTION

SECTION 32 84 00 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to furnish, install and maintain the Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Work Specified Elsewhere

1. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO WORK OF THIS SECTION.
2. 31 20 00 EARTHWORK: EXCAVATION, FILLING, AND GRADING
3. 31 23 00 TRENCH EXCAVATION AND BACKFILLING
4. 32 90 00 LANDSCAPE PLANTING

1.2 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with the following codes adopted and amended by the authority having jurisdiction. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. The work described in these specifications shall govern in the event that the drawings or specifications call for material or methods of construction of higher quality or standard than required by these codes.

1. California Plumbing Code
2. California Administrative Codes:
   a. Title 8, Industrial Relations
   b. Title 19, Public Safety
3. California Electrical Code
4. Standards and Regulations of other agencies, water utility provider, or organizations as listed in this specification relating to products or procedures, e.g. American Society for Testing and Materials.

1.3 DEFINITIONS

A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.

B. PVC: Polyvinyl Chloride.

C. Agencies and Organizations:

1. ASTM- American Society for Testing and Materials
2. AWWA- American Water Works Association
3. IAPMO- International Association of Plumbing and Mechanical Officials

4. NEC - National Electrical Code.
5. UL - Underwriter's Laboratories
6. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.

D. Owner: An authorized representative of the Owner or the Owner's authorized consultant.

1.4 QUALITY ASSURANCE

A. The work of this section shall be performed by a single firm experienced in irrigation work and holding a current California Contractor's A or C27 License.

B. Qualifications of Workers

1. The Contractor shall employ skilled workers who are thoroughly trained and experienced in irrigation system installation and who are completely familiar with the specified requirements and methods needed for proper performance of this work.
2. The Contractor shall provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.

1.5 SUBMITTALS

A. An operational assessment report of any existing irrigation system in the area of work shall be submitted prior to the start of the project's work, including demolition and clearing. See Subsection 1.07, F.

B. The Contractor shall submit complete lists of proposed materials and equipment per the Division 01 Submittal Section, including manufacturer's name and model numbers. Only provide additional product data and/or catalog cut sheets if a substitute material or equipment is proposed. No substitution will be allowed without prior written approval.

C. Shop drawings shall be provided for the layout and description of all equipment assemblies, including dimensions, capacities, and other characteristics as listed in product specifications. Shop drawings for booster pump assemblies shall clearly and neatly indicate the layout of the assemblies and proposed piping in the pump yard, and shall show adjacent equipment, required clearances, walls, fences, piping and other existing permanent improvements affecting the layout. Materials and equipment shall not be ordered until given written acceptance. Equipment or materials installed or furnished without prior approval or acceptance may be rejected and the Contractor shall be required to remove such materials from the site at his own expense.

D. When specific name brands of equipment and materials are used, they are intended as preferred standards only. This does not imply any right upon the part of the Contractor to furnish other materials unless specifically approved in writing as equal in quality and performance by the Owner. Decisions by the Architect/Engineer shall govern as to what name brands of equipment and materials are equal to those specified on the plans and his decisions shall be final. It shall be the responsibility of the Contractor to furnish proof as to equality of any proposed equipment or material.

E. Approval of any item, alternate or substitute indicates only that the products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

F. Acceptance of any submittals, deliverables, or other work product of the Contractor shall not be construed as assent that the Contractor has complied with, nor in any way relieved the Contractor of compliance with (i) the applicable standard of care, and/or (ii) applicable statutes, regulations, rules, guidelines, and contract requirements.

G. Irrigation Equipment: When the Contractor desires to transfer salvaged irrigation equipment and/or new spare equipment and/or parts to the Owner, he must submit along with the equipment an itemized list. The Contractor is solely responsible to obtain a written confirmation by the Owner that all materials received by the Owner matches his material list. The transfer of materials will not be considered executed without written confirmation of same.

H. Submit any required or requested testing data and/or Certificates, including but not limited to the backflow prevention assembly testing Certificate after the assembly is installed prior to regular system operation.

1.6 EXPLANATION OF DRAWINGS

A. The intent of the drawings and specifications is to indicate and specify a complete and efficient sprinkler irrigation system ready for use in accordance with the manufacturer's recommendations, and all applicable local codes and ordinances. Interpretation of irrigation plans and specifications shall be the responsibility of the Landscape Architect or Owner.

B. All existing systems and improvements are shown in their approximate locations. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Owner.

C. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work, and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, utilities, and architectural features will be avoided. Locate pipe, valves and other equipment in planting areas unless specifically noted otherwise.

D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically mentioned in the specifications.

1.7 EXISTING CONDITIONS

A. The Contractor shall not install the irrigation system and equipment as shown on the Drawings when it is obvious in the field that obstructions or differences in existing conditions and/or

systems are present. Such obstructions or differences should be immediately brought to the attention of the Owner. Failure to provide notification prior to the start of this work shall make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage of the system without any additional cost to the Owner.

B. The Contractor shall examine carefully the site of work contemplated and the proposal, plans, specifications, and all other contract documents. By submitting a bid, the Contractor attests that he has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantity of work to be performed and materials to be furnished, and the requirements of the specifications. The Contractor shall take necessary precautions to protect existing site conditions that are to remain. Should damage be incurred, the Contractor shall make the necessary repair or replacement to bring it back to its original condition at his own expense.

C. Prior to cutting into the soil, the Contractor shall coordinate with the Owner to locate all cables, conduits, sewers, septic tanks, and other such underground utilities as are commonly encountered and he shall take proper precaution not to damage or disturb such improvements. If a conflict exists between such obstacles, notify the Owner who will consider realignment of the proposed work. The Contractor will proceed in the same manner if a rock layer or any other condition encountered underground makes change advisable. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.

D. The Contractor shall verify the correctness of all finish grades within the work area in order to insure the proper soil coverage (as specified) of the sprinkler system pipes. The Contractor shall verify and be familiar with location and size of the proposed water supply (P.O.C.). He shall make approved type connection and install new work.

E. The Contractor shall be responsible for notifying the Owner prior to installation that equipment or methods indicated on the drawings or in the specifications conflict with local codes, are incompatible or an error is apparent. It the event the Contractor neglects to do this, he will accept full responsibility for any revisions necessary.

1.8 PERMITS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Any permits for the installation or construction of any of the work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspections and examination required by these authorities.

1.9 TESTING

A. General: Unless otherwise directed, tests shall be witnessed by the Owner. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that

of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Main Line Piping: Maintain 125 psi water or air pressure in new main line piping for a duration of twenty-four (24) hours. There shall be no drop in pressure during test except that due to ambient temperature changes (+/- 5psi).

C. After being installed at the project site, any newly installed Backflow Prevention unit must be tested and approved as functioning properly per the local water agency requirements. Approval of the backflow prevention unit must precede any final inspection of the irrigation system. All costs for testing shall be the responsibility of the Contractor.

1.10 OBSERVATION

A. General:

1. Installation and operations must be approved by the Owner.
2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
3. In all cases, where inspection of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's Representative, the Contractor shall notify the Owner's Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.

B. Periodic observations shall be required for basic operations and installations during progression of the project. The Owner's Representative, Owner or Landscape Architect shall perform the observations and shall record the observation on the Irrigation System Observation Log form on the As Built Record Drawings. Such observations will include but not necessarily be limited to the following items as included in the scope of work:

1. Layout and flagging of sprinkler heads.
2. Trenching.
3. Main line installation.
4. Main line sustained pressure check.
5. Wire placement.
6. Partial fill compaction of trenches.
7. Control valve installation.
8. Drip line installation prior to backfilling.
9. Sprinkler/emitter coverage prior to the start of planting operations.
10. Overall system operation and primary/secondary communication.

C. Coverage & Operations Review:

1. When the irrigation system is operational and prior to soil conditioning operations, the Contractor in the presence of the Owner shall perform a coverage test of the irrigation

system. The Contractor shall furnish all materials and labor required to perform the coverage test and to correct any minor inadequacies of coverage disclosed. The Contractor shall inform the Owner and Owner of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such notification of necessary corrections or additions to the irrigation system is not provided prior to or during the coverage test, the Contractor shall make all subsequent adjustments and corrections needed for proper coverage without any extra cost to the Owner.

2. Prior to the start of the maintenance period, the irrigation system shall be reviewed by the Owner for proper operations, and a review of and training on equipment and associated controls performed. Any corrections and/or adjustment shall be made as a condition for the start of the maintenance period and subsequent Final Acceptance.

D. Final Acceptance: The work will be accepted in writing when the entire project improvements have been completed to the satisfaction of the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary for the Owner to occupy any portion of the work area before the contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's separate work forces.

1.11 REJECTION OF NON-CONFORMING MATERIAL OR WORK

A. The Owner reserves the right to reject any material or work which does not conform to the contract documents. The rejected material or work shall be removed or corrected by the Contractor at no additional cost to the Owner.

1.12 OPERATIONS AND MAINTENANCE INSTRUCTIONS & RECORD DOCUMENTS

A. The Contractor shall prepare and deliver to the Owner’s Representative within ten (10) calendar days prior to completion of the construction and as a prerequisite to the start of the maintenance period, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals. These manuals shall describe the material installed and shall be in sufficient depth to permit operating personnel to understand, operate and maintain all equipment. Spare part lists and related manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall contain the following information:

1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of equipment, with names and addresses of local manufacturer representatives and warranty periods.
2. The Contractor to issue a "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions and that the system functions properly.
3. Complete operating and maintenance instructions and warranties on all major equipment.
4. Complete set of manufacturer's literature and specifications of material installed, including parts list.

5. A list of the controller station number for each control valve if different than the control valve number shown on the drawings.
6. Initial electrical data on each control valve:
    a. Ohms reading for each valve taken at the controller (circuit is OFF).
    b. Voltage reading for each valve taken both at the controller and at the valve (circuit is ON).

B. The contractor shall furnish one set of As-Built full-scale drawings on bond, and two compact disks with complete sets of digital PDF files of all close-out documents after the As-Built Record Drawings have been reviewed and accepted by the Landscape Architect.

1. Label first page of each document, or set of documents, "AS-BUILT PROJECT RECORD" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Prints for this purpose may be obtained from the Owner. This set of drawings shall be kept on the site and shall be used only as a record set. Do not conceal any work until required information is recorded. These drawings shall also serve as work in progress sheets, and the Contractor shall make **neat and legible** annotations thereon daily as the work progresses, showing the work as actually installed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Owner.
2. Drawings: Legibly mark to record actual construction:
    a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and depth of each concealed line or item. Accurately locate each capped, plugged or stubbed line.
    b. Field changes of dimension and detail.
    c. Changes made by Field Order, Addenda, or other change document.
    d. Show the final controller station number for each control valve if different than the control valve number shown on the drawings.
3. Deliver all Close-out Documents (As-Builts) to the Owner. Accompany submittal with transmittal letter in duplicate, containing:
    a. Date.
    b. Project title.
    c. Contractor's name and address.
    d. Title and number of each Record Document (As-Built).
    e. Signature of Contractor or his authorized representative.

C. The Contractor shall provide controller chart(s) as follows:

1. The Contractor shall provide two controller charts for each controller’s area of work.
2. The chart shall show the area of work controlled by the automatic controller and shall be the maximum size that the controller door will allow.
3. Show the controller station number for each control valve if different than the control valve number shown on the drawings.
4. The chart may be a reduced drawing of the actual as-built system. However, in the event the valve numbering is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
5. The chart shall be colored with a different permanent color for each station.
6. The chart shall be enclosed in a waterproof envelope or laminated.

1.13 SPARE PARTS AND EQUIPMENT

A. Prior to the conclusion of the maintenance period, furnish the Owner with the following spare parts and equipment:

1. One quick coupler key with attached hose swivel for each set of four quick coupler valves installed.
2. Ten spare nozzles for each different sprinkler head arc and/or radius nozzle installed.
3. One valve key for the 2" operating nut and/or hand wheel isolation valve.
4. One hundred feet of in-line emitter tubing with ten straight and ten ninety degree compression fittings.

1.14 WORK AREA AND SAFETY

A. The Contractor shall furnish, erect, and maintain all temporary facilities; perform all temporary work during the period of construction, including those herein specified. All facilities shall be maintained in proper and safe operating and sanitary conditions at all times.

B. The Contractor shall comply with the provisions of the Construction Safety Orders, and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations.

C. The project site shall be maintained in a neat and safe condition at all times. Cleanup shall be accomplished as the work progresses and upon completion of the work. The Contractor shall provide adequate safety measures to protect workers and the public from injury.

1.15 GUARANTEE

A. Irrigation system consisting of materials, equipment and workmanship shall be guaranteed for proper operation a minimum of one year from date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later. Manufacturer's warranty periods may be longer, and shall be noted in the close-out documents.

B. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects of materials, equipment or workmanship one year from the date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later.

C. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the Guarantee as herein specified.

D. The Booster Pump Assembly shall have a minimum 2 year warranty with no-cost annual service checks over the Warranty Period. See the Booster Pump Assembly and Controls execution section for additional requirements.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Schedule rated white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785.

B. Class rated (Standard Dimension Ratio) white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1784.

C. PVC pipe shall be of the Class or Schedule as follows:

1. PVC pipe shall meet ASTM D-2241 for solvent weld, plain end, ASTM D-2672 for solvent weld, bell end, and ASTM D-3139 for gasketed bell end. Pipe shall be of the Schedule and/or Class as shown on the Drawings.
2. Pipe sleeves under paving shall be PVC Schedule 40 for 3-inch and smaller or SDR 35 for 4-inch and larger pipes.
3. Riser and/or manifold pipe connecting valves to main line fittings shall be Schedule 80 PVC.

D. All pipes shall be continuously and permanently marked and conform with the following information: manufacturer's name or trademark, nominal pipe size, Schedule or Class of pipe, pressure rating in PSI, ASTM designation and (NSF) seal of approval.

E. White rigid polyvinyl chloride (PVC) Fittings:

1. Schedule 40 type I and II grade 1, solvent weld socket fittings ASTM D-2466 for all lateral lines.
2. Schedule 80 type I and II grade 1 solvent weld socket fittings ASTM D-2464 for all main line less than 4 inches diameter.
3. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable (IPS) schedule, and (NSF) seal of approval.
4. All plastic fittings and connectors shall be injection molded of an improved polyvinyl chloride compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings. Where threads are required in plastic fittings, these shall be injection molded also.

F. PVC Solvent Weld Adhesive: All socket and bell type connections shall be joined with primer and PVC solvent cement which shall meet the requirements of ASTM F656 for primer and ASTM D2564, "Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings." Solvent cement joints for plastic pipe and fittings will be made as prescribed by manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for PVC be used in conjunction with a solvent cement designed for the fit of pipe and fittings specified. A heavy bodied, medium set solvent cement, e.g. Weld-On 711 gray, shall be used for all classes and schedules of pipe and fittings.

G. PVC Pipe Thread Sealant: A non-hardening all purpose sealant and lubricant similar to Permatex #51 or Lasco blue pipe thread sealant which is certified by the manufacturer to be

harmless to PVC pipe and fittings. Apply sealant to clean male threads, brushing into grooves and to the first three threads of the female threads. A good quality grade of teflon tape recommended by the manufacturer for use with plastics may be used in lieu of sealant. Minimum width of tape to be used is 3/4". A minimum of two wraps and a maximum of three wraps to be used.

H. PVC Swing Joints: Connections to sprinkler heads from lateral lines shall be made with swing joints as detailed. Pre-assembled swing joints from Hunter, King Brothers or Spears are acceptable.

1. Use 6” length nipples for 1/2 inch inlet heads.
2. Use 12” length nipples for 3/4 or 1 inch inlet heads.

2.2 BACKFLOW PREVENTION ASSEMBLY

A. Backflow prevention assembly is existing and shall remain in place.

2.3 VALVES

A. Electric Control Valves:

1. Globe valves operated by low-power solenoid, normally closed, manual flow adjustment. Sizes and types as shown on drawings.
2. Provide a pressure regulating module on all control valves, or other pressure regulating components as part of the operating spray head or low volume head zones when the dynamic system pressure is, or may be greater than 45 psi.

B. Control Valve Marking: Christy’s valve identification tag (or equal), yellow color with text designating controller and valve station number, e.g. “A12”, or equivalent.

2.4 VALVE BOXES

A. Control Valve/Master Valve/Flow Sensor boxes:

1. Shrub/Ground Cover areas: Carson 1419 body with lockable tan plastic cover, or equivalent. Drip Valve Kits shall use a Jumbo body with lockable tan plastic cover.
2. Turfgrass areas: Carson 1419 body with lockable green plastic cover, or equivalent.
3. Hardscape areas: Christy B16 concrete box (11.75” x 22.25”) with N16R composite lid, or equivalent.

B. Control Valve box marking: Plastic lids shall have a branded markings, and concrete lids shall have painted text on top of lid with minimum 1" high letters showing controller letter and station number.

2.5 CONTROLLER

A. Controller is existing and shall remain in place. Verify open stations and spare wire, if any in the area of work.

2.6 CONTROL AND TRACER WIRE, COMMUNICATION CABLE

A. Connections between the automatic controllers and the electric control valves, and tracer wire shall be made with direct burial AWG - UF 600 volt copper wire manufactured for irrigation system use.

B. Hot control wires for the first controller shall be red. If multiple controllers are installed, the hot wire color shall be orange, yellow, purple in order for each controller. Common ground wire shall be white, with a color stripe corresponding to the hot control wire color when multiple controllers are installed. Spare control wires shall be black and spare common wire blue. Tracer wire shall be green.

C. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14. Common wire shall be a minimum #12 size.

D. All control wire splices/caps shall be made with direct bury rated, waterproof wire connectors with silicone sealant, Spears DS-500 Dri-Splice, 3M DBR/DBY or approved equal. Use one splice per connector sealing pack.

E. Apply numbered wire markers at both sides of all splices and at the controller terminal board corresponding to the controller and station number. If multiple valves are connected to one station, add a two digit identifier to the station number (X), e.g. X01, X02, etc. Use HellermannTyton Clip-tags nylon numbered wire markers or approved equal.

2.7 IRRIGATION HEADS

A. Spray/Bubbler Pop-up Head: Molded plastic body with pop-up plastic riser and nozzle. Refer to schedule on drawings. Manufacturer's model numbers are listed with description.

B. Rotor Pop-up Head: Molded plastic body with plastic riser and nozzle, stainless steel clad riser if specifically noted or standard. Gear driven rotation with memory arc, balanced nozzle sets. Manufacturer's model numbers are listed with description.

2.8 BOOSTER PUMP ASSEMBLY AND CONTROLS

A. The booster pump is existing and shall remain in place.

2.9 CONCRETE

A. Cast-in-place Portland cement concrete used for pipe encasement, cover, thrust blocks, pipe support or other below-grade use shall at minimum comply with 2,800 psi 28 day strength.

2.10 OTHER MATERIALS

A. Materials not specifically indicated but necessary for the proper execution of this work shall be of first quality as selected by the Contractor subject to the acceptance of the Owner.

B. All materials appearing in the legend and details of the irrigation drawings are to be furnished and installed by the Contractor unless specifically noted to the contrary. Contractor is responsible for installation according to plans and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

C. Granular bedding material shall be clean natural occurring sand, free from clay, salt, sea shells or organic material, suitable for the purpose intended, and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve.

PART 3 - EXECUTION

3.1 SYSTEM DESIGN AND VERIFICATION

A. Contractor shall verify existing pressure and any existing irrigation equipment, and shall inform the Owner of any discrepancies between the exsiting systems' make and model of equipment, such as sprinkler heads, control valves, etc., and those indicated in the Drawings in writing prior to the start of irrigation system installation. Failure to inform the Owner of any discrepancy within seven working days prior to beginning of system installation will place the responsibility of any and all corrective action on the Contractor at no expense to the Owner.

3.2 PIPING INSTALLATION

A. General:

1. Any equipment installed by the Contractor and deemed to be for the use of the Owner in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Equipment deemed by the Owner to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Any changes made by the Contractor shall be done without any additional cost to the Owner.
2. The Contractor shall be responsible for layout of proposed facilities and any minor adjustments required due to differences between existing conditions and the Drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. The Owner will indicate the proposed precise location of the control panels. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Where head spacing is not specifically noted, Contractor shall install sprinkler heads evenly along the irrigation area's perimeter. Flush all lines prior to installation of heads.
3. Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance to manufacturer's recommendations to allow for expansion. Lay on solid bedding, at uniform depth.

B. The Contractor shall examine all other portions of working drawings and plan trenching and pipe layout so that no conflict will arise between irrigation and any other work. Any corrective action will be the Contractors responsibility at no further expense to the Owner.

C. Excavations:

1. Excavations shall be open vertical construction, sufficiently wide to provide clear working space around the work installed and to provide ample space for backfilling and tamping.
2. The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Owner. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Owner and Owner. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Owner, plowing shall be terminated.
3. Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.
4. Unless written approval for using native soils as bedding material is given by the Owner, main line pipe shall be placed on a minimum 6 inch depth of granular bedding material.
5. Excess trench soil with rocks greater than ½ inch diameter shall be removed from the planted area and spread as directed by the Owner.
6. When two pipes are to be placed in the same trench, it is required to maintain a minimum four inch (4") horizontal separation between pipes.
7. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
    a. 24-inch minimum over main lines.
    b. 18-inch minimum over non-pressure (rotary pop-up) lateral lines.
    c. 12-inch minimum over non-pressure (pop-up spray head) lateral lines.
    d. 24-inch minimum over any lines located out in road surface area of paved streets.
    e. Maximum cover above the top of the pipe shall not exceed twelve inches (12") greater than the required minimum cover.
    f. 12-inch minimum cover over drip line non-pressure lateral lines.
    g. 4-inch minimum cover over in-line emitter or main distribution tubing.

D. Assemblies:

1. Routing of pressure supply lines as indicated on drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details on plans.
2. Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice.
3. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
4. All threaded pipe and fittings shall be assembled using an approved teflon tape, or equivalent, applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
5. No main line elbows, branch tees or isolation valves are to be located closer than five (5) feet to each other without prior approval of the Owner.

E. Line Clearance: All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Plastic to Steel Connections:

1. At all plastic (PVC) pipe connections, the Contractor shall work the steel connections first. Connections shall always be plastic into steel, never steel into plastic. An approved teflon tape shall be used on all threaded (PVC) to steel, never steel into plastic. An approved teflon tape shall be used on all thread (PVC) to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved 3/4" wide teflon tape will be required.
2. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

G. Plastic Pipe:

1. The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point.
    a. All lumber, rubbish, rubble, concrete and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.
    b. Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. One additional foot per one hundred (100) feet of pipe is the minimum allowance for snaking. Never lay pipe when there is water in the trench or when the temperature is 32 degrees F or below.
    c. All changes in direction of pipe shall be made with fittings, not by bending. No main line fittings for changes in direction shall be greater than 45 degrees. Provide a minimum five (5) feet between changes in direction elbows.
    d. Safely handle primers and cements per ASTM F-402. Make solvent weld joints per ASTM D-2855 with a non-synthetic bristle brush in the following sequence:
        1) Make sure pipe is cut square and all rough edges and burrs are removed. All connecting surfaces are properly cleaned and dry prior to application of pipe primer.
        2) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.
        3) Apply an even coat of solvent to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
        4) Apply an even light coat of solvent to the inside of the fitting.
        5) Apply a second coat of solvent to the pipe.
        6) Insert the pipe quickly into the fitting and turn pipe approximately one-eighth to one-quarter turn to distribute the solvent and remove air bubbles. Hold the

joint for approximately fifteen seconds so the fittings do not push off the pipe.

7) Using a clean rag, make sure to wipe off all excess solvent to prevent weakening at joint.
8) Exercise care in going to the next joint so that pipe is not twisted, thereby disturbing the last completed joint.
9) Allow at least fifteen minutes setup time for each welded joint before moving.
10) Repairing plastic pipe when damaged shall be done by replacing the damaged portion of pipe.

H. Concrete Thrust Blocks: Concrete anchors or thrust blocks shall be provided on pressure main pipelines 2 inches or greater in diameter at abrupt changes in pipeline grade, changes in horizontal alignment (bends, tees and crosses), reduction in pipe size (reducers, reducing tees or crosses), end-line caps or plugs, and/or in-line isolation valve to absorb any axial thrust of the pipeline. The pipe manufacturer's recommendation for thrust control shall be followed. Thrust blocks must be formed against solid unexcavated earth (undisturbed). Do not enclose entire joint in concrete. Provide a minimum of two cubic feet of concrete for each thrust block.

I. Concrete thrust blocks may be eliminated if the main line piping system uses self-restrainted fittings and bell joint restraints throughout.

3.3 PIPE DEPTH AND BACKFILL

A. Backfill shall not be placed until the installed system has been inspected, pressure tested and approved by the Owner.

B. Backfill for first 6 inches underneath, and 4 inches around and above main line pipe and control wires shall be granular bedding material, unless the Owner approves in writing that native soil may be used for initial backfill in lieu of granular bedding material. Backfill material for the upper portion of the trench shall be approved soil. Unsuitable martial, such as pipe remnants and wire including clods and rocks over two inches (2") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.

C. Backfilling for all pipe shall be carried out in two basic stages.

1. Stage One Backfilling: This shall be accomplished as soon as possible after the pipe is laid. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding material should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.
2. Stage Two Backfilling: This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill material in four inch (4") layers and hand tamp to achieve density similar to adjacent soil. After twelve inches (12") in main line trenches and eight inches (8") in lateral line trenches of hand tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in six inch (6") layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to

avoid damage to the pipe from machinery that is too heavy. All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks uncovered and not used as backfill must be collected and removed from the site.

D. All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and puddled to eliminate any voids.

E. Surplus earth remaining after backfilling shall be disposed of as directed by the Owner.

F. PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of temperature of the pipe may cause separation of joints or fittings.

G. Contractor shall fill with properly amended topsoil any irrigation trench that subsides during the warranty period. Contractor shall assume all cost associated with the trench repair, including but not limited to plant replacement of a size of plant disturbed at the time of the repair.

3.4 BACKFLOW PREVENTION ASSEMBLY

A. Review the backflow prevention assembly. Note any leaks or improper operation and report to Owner.

3.5 CONTROL AND TRACER WIRE

A. Protect wire by running alongside of mainline piping. Do not tape wire together when encased in sleeve. Minimum cover shall be 24 inches. Crimp wires together at valve manifold with Scotchlok connector. Conventional valve wire splices shall use a 3M DBY splice kit. Tag all control wire at splices with approved control wire markers.

B. Wire size shall be determined by the number of valves operating on a given wire and the distance from the controller to the farthest valve, as specified by the charts furnished by the remote control valve manufacturer. Splices are only allowed when rerouting or repairing existing wire. All splice connections must be provided in a valve box.

C. Install tracer wire along the top of pipe at the following locations:

1. All pipe sleeves.
2. Main line pipe without adjacent control wire.

3.6 VALVES

A. The Contractor shall make all necessary connections for operation, and shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Where pressure regulating electric control valves are specified, the Contractor shall adjust the valve so a

uniform distribution of water is applied by the heads, and that the most remote heads operate at the pressure recommended by the head manufacturer.

B. Each valve is to be enclosed in a separate valve box. The valve box shall be secured on firm soil clear of valves and wiring connections. Valve boxes and lids shall be set to finished grade or as indicated on the Drawings. Use valve box extensions of the same material as the box to the proper depth below the pipeline. Valve boxes shall be supported by common bricks at each corner and at the long side of the box. Use a minimum of six bricks to support rectangular boxes and four bricks to support round boxes. Backfill carefully and properly compact in order to prevent settlement and subsequent damage.

C. Install a concrete collar around valve boxes when located in asphaltic concrete pavement or in turfgrass areas.

D. When existing valve and/or splice boxes are within the area of work, replace in kind any damaged boxes and/or lids, unless noted otherwise. Adjust the elevation of all existing boxes within the area of work to final grade per the drawings.

E. Locate valve boxes in ground cover/shrub planting areas instead of turfgrass areas whenever possible. Locate valve boxes 18” from and perpendicular to adjacent paving. When grouped together, provide equal spacing of at least 36" between boxes.

F. Permanently attach the plastic valve identification tag to the remote control valve body and locate so it’s clearly visible in an open valve box.

G. Permanently secure the control valve identification label to the top of the valve box lid with non-corrosive connectors.

3.7 AUTOMATIC CONTROLS

A. Connect operational control wires or accessory components to the controller, and program valve schedules appropriately for the new planting.

B. The Owner shall review the fully functional operation of the irrigation control system prior to acceptance of the system, and as a requirement for the start of maintenance.

C. Install automatic controller chart in laminated or watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller in the work area.

3.8 SPRINKLER HEAD INSTALLATION

A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Flush all lines prior to installation of heads.

B. Overhead distribution sprinkler heads shall be installed as detailed, set adjacent to the edge of hardscape elements (6 inches for spray heads, 12 inches for rotary heads) and perpendicular to

the finish grade. Sprinkler heads shall be a minimum 2 feet, and preferably 3 feet (if planting layout permits) from building walls.

C. Where individual shrub bubblers are installed, each plant shall have a bubbler within 12 inches or less of the shrub rootball.

D. Upon completion of the installation, the Contractor shall adjust or change sprinkler head nozzles to uniformly distribute water without overspray and shall place entire irrigation system in first-class operating condition without any additional cost to the Owner.

E. Sprinkler heads shall be adjusted in order by fully opening the sprinkler furthest from the control valve and working back toward the control valve. Adjust sprinkler heads which spray toward buildings or adjacent hardscape so that water spray does not contact the side of buildings or significantly over-spray onto hardscape .

3.9 CONCRETE

A. Concrete shall be installed in accordance with the relevant portions of the Site Concrete specification section.

3.10 COMPLETION AND MAINTENANCE

A. After the system has been completed but prior to the start of maintenance, the Contractor shall operate the automated system with the Owner, shall instruct the Owner in the operations and maintenance of the system and controls, and shall program the controller for each station. If site central control system equipment is installed, the authorized central control distributor/installer shall program the central base station to communicate with the site control system, and shall verify that proper communication protocols are operational.

B. The irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the maintenance period or until Final Acceptance of the project, whichever is greater. Irrigation system maintenance shall commence upon an acceptable review following the completion of irrigation installation, planting operations and general clean-up.

C. The maintenance period shall not terminate until the close-out documents and as-builts record drawings have been submitted and accepted.

3.11 REPAIR AND CLEAN-UP

A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to new planting and improvements. Disturbed and/or damaged areas shall be restored to their original condition to the satisfaction of the Owner.

B. Where trenching or other work disturbs newly planted turfgrass or planting, the Contractor shall reinstall the existing sod if viable, or install a full width of new turfgrass sod or planting to match the existing turfgrass/planting species/variety and size, after first conditioning the top 6

inches of soil per the Landscape Planting specification. Adjust finish grades to account for the new turfgrass sod's soil mat so that the new sod is flush to the adjacent turfgrass.

C. After the irrigation operations are completed, the Contractor shall remove all trash, excess materials, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired or material replaced at the Contractor's expense. The site shall be left in a neat and orderly condition to the satisfaction of the Owner.

END OF SECTION

SECTION 32 90 00 - LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all material, labor and equipment necessary to install all landscape work as indicated in the plans and specifications.

B. The landscape work includes but is not necessarily limited to the following:
1. Soil preparation including cross ripping of all planting soil.
2. Weed control including an application of a pre-emergent herbicide.
3. Providing import planting topsoil at raised grade planters and/or at planting areas needing fill.
4. Fine grading, conditioning and amending planting topsoil.
5. Installation of turfgrass.
6. Planting new trees, plants and ground covers.
7. Tree drainage sump boring and testing.
8. Installation of mulch.
9. Sixty (60) day maintenance.

C. Related Work Specified Elsewhere
1. CONTRACT DRAWINGS, ADDENDA, GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS, AND DIVISION 1 SECTIONS APPLY TO WORK OF THIS SECTION.
2. 31 20 00 EARTHWORK: EXCAVATION, FILLING, AND GRADING
3. 31 22 22 SOIL MATERIALS
4. 32 01 90 EXISTING LANDSCAPE PROTECTION
5. 32 84 00 IRRIGATION SYSTEM

1.2 DEFINITIONS

A. Unless noted otherwise, the term "approved" shall mean by the Owner in writing.

B. Agencies and Organizations:
1. ASTM- American Society for Testing and Materials
2. ANSI – American National Standards Institute
3. ISA – International Society of Arborists
4. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.
5. TPI – Turfgrass Producers International

C. Owner: The Owner’s authorized representative or authorized consultant.

1.3 QUALITY ASSURANCE

A. The work of this Section shall be performed by a single firm experienced in landscape planting

and holding a current California Contractor's A or C27 License.

B. Tree and plant quality and sizes shall conform to the current edition of "American Standard for Nursery Stock" for Number One nursery stock as adopted by the American Nursery & Landscape Association (ANSI Z60.1). Plants shall be of uniform, standard size for their listed container size, neither overgrown and root bound or encircling, nor so recently transplanted that the root system is not thoroughly well established throughout the container. Roots should reach the sides of the container and maintain a firm root ball. Pruning shall not be done prior to delivery except by prior approval.

C. Trees shall also comply with quality characteristics described in "Guideline Specifications for Nursery Tree Quality" current edition, published by the Urban Tree Foundation. Trees not in compliance with any of the following characteristics may be subject to removal and replacement, whether planted or still in their containers.
   1. Acceptable caliper and height ranges for the Type, Form and Size of tree.
   2. An intact central leader, or after heading of an old leader, the new leader diameter is greater than one-half the diameter of the old leader. Co-dominant leaders are not acceptable.
   3. Scaffold branch diameters are less than two-thirds the diameter of the trunk, and without included bark at the attachment.
   4. Scaffold branches shall be balanced, well spaced vertically, and with a radially blank section no greater than one-third of the canopy circumference.
   5. Temporary branches on the lower trunk shall be less than three-eighths inch diameter, and the clear trunk height shall be no more than forty (40) percent of the overall tree height.
   6. The root collar and rootball shall be free of defects, including circling, kinked and girdling roots. Roots at the edge and bottom of the container shall be less than one-quarter inch diameter, and uniformly distributed throughout the container.
   7. The tree canopy width shall be a minimum of twenty-five percent of the standard form tree height, except for naturally columnar forms.

D. Botanical names shall take precedence over common names. Provide plants that are true to name. Tag one representative plant of each species and size with the botanical name and size.

E. Inspection:
   1. All landscape work and materials shall comply with applicable Federal, State, County and City regulations.
   2. All plant material shall be reviewed onsite by the Owner's Representative and/or Landscape Architect prior to positioning and planting. Review shall not limit the right of rejection during any stage of the work until Final Acceptance for any reason including condition of the foliage or root ball, size, variety, form, appearance, latent defects or injuries. Rejected plants shall be removed from the site and replaced immediately by the Contractor at no additional cost to the Owner.

F. Qualifications of Workers
   1. Employ skilled workers who are thoroughly trained experienced in landscape planting and who are completely familiar with specified requirements and methods needed for proper performance of the work in this section.
   2. Provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.
   3. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation.

Submit a copy of the Certificate.

G. Any pruning of existing trees specified as part of this Work shall be performed under the direct supervision of an ISA Certified Arborist and in compliance with ANSI A300-Part 1 Standard Practices (Pruning).

1.4 SUBMITTALS

A. In accordance with the Submittal section, submit:
   1. A complete materials list of all items proposed to be furnished including estimated quantities.
   2. Laboratory analyses of soil conditioning materials shall have been performed within one year of the submittal date.
   3. Quality Certificates and/or Certificates of Inspection required by government agencies (providing duplicate copies for the Owner's Representative).
   4. Qualified Applicator Certificate, and DPR Registration Certificates and Material Safety Data Sheets for all pesticides/herbicides proposed for use.
   5. Submit photos with a scale marker of all boxed trees proposed for use from the nursery source. Photos shall clearly show the individual tree form without background greenery.

B. Soil amendments: Submit one (1) pint sample and an analysis of organic compost and mulch.

C. Other Samples: When requested by the Landscape Architect and/or Owner's Representative.

D. Soil Fertility Analysis and Recommendations:
   1. The Contractor shall provide and pay for a fertility analysis of the existing topsoil and any proposed import planting topsoil. After mass grading operations are completed, native soil samples shall be collected for the fertility analysis by collecting a minimum of 5 representative samples of the soil per acre throughout the area of work. Separate samples shall be produced for cut and fill areas, and for any other area composed of soils not similar to the existing soils. Each sample shall be a minimum of one pint each, and shall be thoroughly mixed together to prepare a homogenous sample. A one quart representative sample for cut, fill and any other special conditions shall be submitted to the soil testing laboratory as a representative sample for fertility analysis. The fertility analysis shall at a minimum provide the following data:
      a. soil texture class and percent sands, silts and clays per ASTM D422
      b. estimated soil infiltration and percolation rates
      c. pH
      d. organic matter (%)
      e. total soluble salts (ECe)
      f. Cation Exchange Capacity (CEC) and Percent Cation Saturation for K, Mg, Ca and Na
      g. major and minor nutrients (ppm).
   2. Recommendations for improvement of the soil conditions for optimum plant growth shall be made by the testing laboratory, and at a minimum shall include the following:
      a. A fertilizer and amendment application program (including macro and micro nutrients) for both pre-planting and maintenance fertility applications for broad area tillage and for planting pit backfill (pre-plant only).
      b. Treatments to neutralize soil pH and to correct any adverse conditions as warranted.
      c. Recommendations shall address soil conditioning for both planting area tillage and

tree/plant planting pit backfill.

3. The soil analysis and recommendations shall be performed by one of the following laboratories capable of providing the above analyses by a licensed soil scientist:
   a. D&D Agricultural Laboratory. Contact Darrin Peters at 559-348-1818.
   b. Wilber-Ellis Company. Contact Michael Cline at 209-442-1220.
4. The Contractor shall submit the results of the soil testing investigations and shall receive written direction from the Landscape Architect before proceeding with any soil conditioning activities such as fertilizing and/or adding amendments.

E. Within seven days from the start of the maintenance period, submit a calendar of maintenance activities, including scheduled dates for mowing, fertilizing, weed control and all other activities. Provide the quantities of maintenance fertilizer and any other materials scheduled to be used in each application during the maintenance period.

F. Submit invoices and/or delivery tags from material suppliers for all amendments, fertilizer, seed, plants, mulch and any other materials provided for the landscape planting installation and applied during the maintenance period. Submit tags from seed packaging indicating seed varieties, percent purity and percent germination minimums. The invoices and/or delivery tags shall be provided directly to the Owner’s Representative/Inspector of Record within 24 hours of delivery to the site, as well as to the normal submittal recipients per the Contract Documents.

G. Close Out Documents: Submit prior to the start of the maintenance period, two bound copies of the following:
1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of plant nurseries, materials and equipment vendors with names and addresses of the vendor/manufacturer representatives and warranty periods.
2. A "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions.
3. Maintenance Manuals and Instructions: Submit a monthly schedule of procedures to be established by Owner for maintenance of landscapes (trees, mixed planting and turfgrass) for one full year and shall include recommendations for fertilizing, pest and disease control, mowing, aeration and top dressing.
4. Soil Amendment and Seed/Stolon Confirmation Form noting the installed quantities of materials and the person who confirmed the delivery and installation of the materials.
5. Operations and Maintenance Manuals and Warranty certificates for any maintenance equipment turned over to the Owner.
6. As-built Record Drawings with all modifications to the Drawings noted in red ink, and the Landscape Planting Observation Log completed.

1.5 AVAILABILITY

A. The Contractor shall confirm availability of plants, supplies, and materials prior to submitting his landscape bid. Plant variety substitutions are not desired.

B. If a plant is found not to be suitable or available, the Contractor is to notify Landscape Architect before bidding. The Landscape Architect is then required to select a reasonable alternate and to inform all those bidding of the availability of the original plant. If a substitute is selected it must be of the same size, value and quality as the original plant. Failure to inform the Landscape Architect of unavailable plants prior to bidding will require that all plants specified shall be provided by the Contractor at time of installation.

C. Plant container size listed on construction documents are minimum acceptable size. If plant material specified is not substituted prior to award of the contract the minimum container size specified shall be provided by the Contractor. If the Contractor can not provide the minimum specified size plant material at the time of installation, the Contractor shall be required to install a larger size container of the plant specified at no additional cost to the Owner.

1.6 EXISTING CONDITIONS

A. The Contractor is to visit the job site to verify existing conditions including soils, vegetative growth, subsurface conditions, existing grade and drainage, irrigation system etc. making allowances in his bid for any required work to provide the landscape installation as specified in the construction documents.

B. The Contractor shall notify the Owner to locate underground lines prior to hole boring or trenching. Do not permit heavy equipment such as trucks, rollers, or tractors to damage utilities. Hand excavate as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned. Prevent damage to temporary risers of underground irrigation system and similar obstructing work located in the landscape areas.

C. If there is a conflict with existing utilities, improvements and/or planting and the proposed planting, Contractor shall promptly notify the Owner's Representative for instructions as to further action. Failure to do so will make Contractor liable for any and all damage or corrective actions arising from his operations.

D. Prior to the start of this work, the Contractor and the Owner’s Representative shall verify the operational condition of that portion of the existing irrigation system pertaining to the proposed planting area. The Contractor shall notify the Owner’s Representative of any repairs and/or corrections necessary for proper functioning and coverage. The repairs and/or corrections shall be completed before any plant material is planted. Failure to perform system verification and provide notification prior to the start of this work will make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage, as well as any required plant replacement, without any additional cost to the Owner.

E. No plants shall be planted in situations that show poor drainage infiltration or low areas that result in standing water. Such situations shall be corrected by the Contractor as directed by the Landscape Architect or Civil Engineer. Failure by the Contractor to notify the Owner of poor drainage conditions prior to proceeding with the conditioning or planting operations shall place the responsibility for any plant removals, additional soil conditioning and replanting on the Contractor without any additional cost to the Owner. Any corrections of finish grading not in compliance with the Contract Documents including plant removal, soil conditioning and replanting shall be performed by the Contractor at no additional cost to the Owner.

1.7 PROTECTION

A. The Contractor shall guarantee repair of damage to any part of the premises resulting from but not limited to leaks, defects in materials or workmanship, operation of equipment, storage of materials and/or equipment, installation of underground or overhead utilities. The Contractor shall be liable for any and all accidents resulting from his work, including open holes and trenches during construction.

B. Protect new and existing landscape areas in the area of work from theft, loss, damage and deterioration during storage, installation and maintenance. Protect from unauthorized persons (trespassers) as well as from operations by other contractors and tradesmen, and landscape operations. Protect all planted turf and shrub areas from persons as well as operations of other contractors and the Owner. Cost of protection shall be born by the Contractor with means of protection such as temporary fencing as approved by Owner. Cost for protection shall be included in the Contractor's bid for the work.

C. Contractor shall repair or replace damaged work and/or damage to existing improvements/landscape as identified by the Owner's Representative to a condition acceptable to the Owner's Representative. No additional payment will be made to the Contractor for repair or replacement of damaged work and/or damage to existing improvements/landscape.

1.8 OBSERVATIONS

A. The Owner's Representative, Project Inspector or Landscape Architect shall perform periodic observations and shall record the observation on the Landscape Planting Observation Log form on the As Built Record Drawings. Such observations shall include but are not necessarily be limited to:
   1. Weed control operations prior to other portions of work.
   2. Ripping and soil conditioning of the planting area.
   3. Layout of the plant material and trees at the site prior to planting in order to avoid conflicts and to meet the design intent.
   4. Condition and quality of plant material prior to planting.
   5. Auguring, digging and preparation of plant pits and drainage sumps for trees and shrubs.
   6. Planting and staking of trees.
   7. Planting of shrubs, ground cover and turfgrass.

B. Any corrective action called for shall be immediately performed by the Contractor.

C. Failure by the Contractor to obtain the above observations shall place the responsibility on the Contractor for any relocation and/or replacement of planted trees or shrubs.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Plant label shall identify each species and variety. A label shall be attached to each individual plant or block of identical plants grouped together.

B. Adequately protect plants from sun and wind prior to planting. Do not allow stored plant material to dry out at any time.

C. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site. Store materials and equipment in a location as directed by the Owner's Representative.

1.10 PESTICIDE NOTIFICATION

A. A written notification of any and all pesticide/herbicide products scheduled for use by the Contractor or their representative on the Owner's property must be submitted to the Owner's

Representative at least seven days prior to the scheduled application. Notification shall include the product name, manufacturer's name, the pesticide active ingredient, the U.S. EPA and CalDPR registration numbers, the scheduled date and application areas, and the reason (target species) for the application.

1.11 REPAIR OF DAMAGED EXISTING PLANTING AREAS

A. The Contractor shall be responsible to repair all damage and/or distress to existing planting areas including turfgrass, shrubs, ground covers, perennials, etc., whether specifically shown on the Contract Documents or not, as a result of construction operations, material and/or equipment storage, site access, site offices, utility and/or irrigation line installations or other actions.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil used in planting areas shall be a clean, friable soil with no noxious weeds, clods or stones larger than 0.5 inch in diameter, subsoil, hardpan, wood, debris, fine organic material greater than 5%, undesirable insects, plant disease or any other natural or extraneous objects detrimental to normal plant growth to a minimum depth of 18 inches from finish grade.

B. The Contractor shall provide a particle size analysis, fertility testing and amendment recommendations of proposed native and/or import topsoil, and the Landscape Architect reserves the right to reject topsoil not conforming to the minimum specifications. Stockpiled onsite topsoil may be used if analysis and testing determines compliance with these requirements prior to placement. Failure to meet minimum specifications shall result in the removal of any unauthorized placed topsoil at the Contractors expense.

C. Particle size distribution for topsoil shall meet the following per ASTM D422:
   1. 100% passing a 12.2 mm (1/2") screen.
   2. Minimum 95% passing a 9.5 mm (3/8") screen.
   3. Minimum 75% passing a 2.36 mm (No. 8) screen.
   4. Maximum 45% passing a No. 200 screen.
   5. Silt content shall be a maximum 35%.
   6. Clay content shall be a maximum 25%.
   7. Silt to Clay ratio shall be less than 2 and greater than 0.5.

D. Other characteristics shall conform to the following:
   1. Permeability rate shall be not less than one (1.0) inch per hour or not more than 20 inches per hour.
   2. The sodium absorption ratio (SAR) shall not exceed 3.0 and the electrical conductivity (ECe) shall not exceed 2.5 milliohms per centimeter at 25 degrees centigrade.
   3. Soluble boron shall be no greater than 1.0 part per million (mg/l).
   4. Soil pH range shall be 6.5 – 7.9.
   5. Maximum concentration of soluble chloride shall be 150 parts per million.
   6. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
      a. Arsenic: 0.5 ppm

b.	Cadmium:	0.5 ppm
c.	Chromium:	5 ppm
d.	Cobalt:	1 ppm
e.	Lead:	15 ppm
f.	Mercury:	0.5 ppm
g.	Nickel:	2.5 ppm
h.	Selenium:	1.5 ppm
i.	Silver:	0.25 ppm
j.	Vanadium:	1.5 ppm

7. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
8. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

2.2 SOIL AMENDMENTS

A. Organic Compost: “Harvest Premium” as supplied by Harvest Power (559) 435-1114; “WonderGrow Compost” by Grover, Inc. (866) 764-5765, or “Allgro Compost” by Synagro (559) 341-5158, and conforming to the following minimums:
   1. Certified as “Mature” or better per the California Compost Quality Council Maturity Index.
   2. Pass EPA Class A standards for pathogens and heavy metals.
   3. Particle size: 1/8" maximum.
   4. pH: 6.5-7.5.
   5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
   6. AgIndex ratio greater than 2.
   7. Organic matter content greater than 25% dry weight.
   8. Carbon/Nitrogen ratio: less than or equal to 25.
   9. Salinity (ECe): less than 5.0 dS/m.
   10. Odor shall be soil-like (musty or moldy) without any sour, ammonia-like or putrid smell.

B. Gypsum shall be mined agricultural grade gypsum composed of no less than 100% $CaS0_4$-$2H_20$ hydrated calcium sulfate in a pelletized form. Elemental Sulfur shall be a minimum 95% pure agricultural grade.

C. Dry Humate organic soil conditioner comprised of 70% humic acid from Leonardite.

D. Endo 120 Mycorrhizae containing a minimum 60,000 living propagules per pound.

E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.3 FERTILIZER

A. Trees and Shrubs: Fertilizer for all trees and shrubs to be BEST PAKS (20-10-5) controlled release fertilizer in a biodegradable 10 gram packet. The BEST PAKS shall be applied at the following rates:
   1. 1 Gallon Can: 1 Best-Pak
   2. 2 Gallon Can: 2 Best-Paks
   3. 5 Gallon Can: 5 Best-Paks

4. 15 Gallon Can: 10 Best-Paks
5. 24” Box: 16 Best-Paks
6. 36” Box: 24 Best-Paks

B. The pre-plant fertilizer shall be a commercial homogeneous, granular pellet:
   1. Pre-plant fertilizer for turfgrass shall be:
      a. BEST 6-24-24-5S XB+ with Avail
   2. Pre-plant fertilizer for mixed plantings shall be:
      a. BEST Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.

C. The maintenance fertilizer shall be a commercial homogeneous, granular pellet:
   1. Maintenance fertilizer for turfgrass shall be one or more of the following:
      a. Urea 46-0-0
      b. BEST Ammonia Sulfate 21-0-0-24S, standard grade, or equal
      c. BEST Nitra King 21-2-4-14S-2Fe, or equal.
      d. BEST Nitex 20-2-3-12S-5Fe, or equal.
      e. BEST Polyon 43 (43-0-0) slow release N, or equal.
      f. Wil-Gro Pro Choice Plus, 31-3-7-6S-3Fe with 9.3% slow release N, or equal.
      g. Best Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.
   2. Maintenance fertilizer for mixed plantings shall be the pre-planting fertilizer. Use slow release above for one time fertilization.

D. Fertilizer material types and analysis may be subject to change based on the findings and recommendations from the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.4 MULCH

A. Mulch for on-grade or raised native soil planters shall be a walk-on type of chipped and aged greenwaste woody material without leaves, green wood, sticks, dirt, stones, dust and other non-organic debris as accepted by the Landscape Architect. Particle size 1/2” to 3" in general size.

2.5 STAKING & GUYING MATERIALS

A. Stakes: 2" Diameter lodgepole pine, pressure treated and pointed one end.

B. Ties: V.I.T. Cinch Tie, 32 inches long, V.I.T. Products, Inc. (619) 673-1760, or equivalent.

2.6 PLANTS

A. Plants shall be typical of their species and variety, shall have normal growth habits, well developed branches and be densely foliated, and shall have fibrous root systems. No substitutions will be allowed unless approved in writing by the Landscape Architect.

B. Plants shall be free from defects and injuries including disease, insects, insect eggs and larvae and girdled or matted roots.

C. Quality and size of plants shall be in accordance with ANSI Z60.1-2004, "American Standard for Nursery Stock", and as described in Quality Assurance.

D. Plants shall not be pruned before planting.

E. Plant material must be selected from nurseries that have been inspected by State or Federal Agencies.

F. Plants shall be nursery grown and shall have been transplanted or root pruned at least once in the past three (3) years. Plants shall have been grown under climatic conditions similar to those in the locality of the project.

G. Each bundle of plants shall be properly identified by weatherproof labels securely attached thereto before delivery to the project site. Label shall identify plant by name.

H. Nomenclature shall be in accordance with Sunset Western Garden Book, current edition.

I. No plants shall be removed from their container until a review has been made in the field or at the nursery, or except when specifically authorized in writing by the Owner.

J. Collected plant material may be used only when approved. Approval shall not limit the right of rejection during work progress for conditions of the root ball, latent defects or injuries.

K. Where shown a "MULTI" provide trees with a minimum of three trunks.

L. Plant sizes listed on the planting plan are minimum acceptable sizes. The quantities listed are the Landscape Architect's estimate only. The Contractor is responsible for the quantities of plant symbols shown on the plan, and/or the quantities in hatched planting areas at the specified triangular spacing.

2.7 TURFGRASS SOD

A. Sod shall be produced from certified or approved seed/stolons, fresh and labeled in accordance with U. S. Department of Agriculture Rules and Regulations. Sod quality shall be Premium or Standard Grade per TPI specifications. Harvested sod shall be big roll size.

B. Sod shall be neatly mowed and be mature enough that when grasped at one end it can be picked up and handled without damage, delivered to the project site, adequately protected and installation commenced within 24 hours of harvesting.

C. Turfgrass shall be a species and variety as specified in the Contract Drawings. If a warm-season grass is specified and the installation is to be performed between the months of October and April, a species with an established perennial ryegrass overseeding shall be installed. Submit the overseeded product information for approval prior to the installation.

2.8 TREE TRUNK PROTECTOR

A. ArborGard+ polyethylene tree guard by Dimex (800) 334-3776, or equal.

2.9 HERBICIDES

A. Herbicide products for removal of unwanted grass and broad-leafed weeds shall be registered and approved for use by the U.S. EPA and CalDPR, and shall comply with the Owner's Standards and with the "Healthy Schools Act" with current amendments.

B. Provide pre-emergent and post-emergent, selective herbicide formulations for use on turfgrass areas and/or ornamental shrub/ground cover areas that are not injurious to the proposed plantings and turfgrasses.

C. Provide a non-selective contact herbicide formulation for use on existing established weeds.

2.10 OTHER MATERIALS

A. Materials not specifically indicated, but necessary for proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

PART 3 - EXECUTION

3.1 EXAMINATION & PREPARATION

A. General: Verify that existing site conditions are as specified and indicated before beginning this work.

B. Damaged Earth: Verify that earth rendered unfit to receive planting due to concrete water, mortar, limewater, hydrocarbons or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Owner's Representative.

C. Examine the area and conditions under which the work in this section is to be performed. Verify that any existing irrigation system within the limit of work is in proper working order with full coverage. Correct conditions detrimental to the timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of the work signifies acceptance of the existing conditions.

D. Protection:
   1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment within the area of work prior to commencing work.
   2. Mark existing irrigation heads, valves, valve boxes and other below grade equipment or components that are scheduled to remain. Protect in place.

E. Runoff and Erosion Control: Furnish equipment, materials and labor necessary to control the flow, drainage, and accumulation of excess water running off the work area and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site per the approved SWPPP.

3.2 ROUGH GRADING, SOIL PREPARATION, PLANTER BACKFILL

A. Rough grading shall be performed by other subcontractors to the extent of establishing rough pads, slopes and drainage patterns. The Contractor is responsible for placement of topsoil and grading required to ensure positive drainage in all turfgrass and planting areas. All planting areas shall have a minimum topsoil depth of 18 inches from on-site native and/or approved import sources. Rough grading shall be completed prior to weed control, cross ripping or rock removal operations.

B. After the completion and acceptance of the weed control operations outlined below, and unless directed otherwise by the Landscape Architect or noted on the Drawings, and except for the area under the canopy of existing trees, the Contractor shall cross rip and till (break up large clumps and clods in excess of 2 inch diameter) the existing soil within all planting areas outside the canopy drip line of existing trees until the soil is loose and friable. Ripping shall be to a minimum depth of twelve inches (12") in turfgrass areas and eighteen inches (18”) in shrub/ground cover areas, with ripping tines a maximum 18” apart performed in a minimum of four passes total in different directions (perpendicular and diagonal). The Contractor shall review the completed ripping operation with the Owner’s Representative and Landscape Architect to determine compliance. The first 6 inches of any new topsoil fill shall be tilled into the existing soil to a minimum depth of 6 inches prior to placing any further topsoil fill. The Contractor shall provide any additional work as directed by the Owner’s Representative after the review to obtain compliance. Do not proceed with the addition of topsoil and/or amendments, or commence rock picking or fine grading until the completed ripping operation is accepted in writing by the Owner’s Representative.

C. Planting area soil under the canopy drip line of existing trees, or in planting beds not accessible by motorized equipment, shall be ripped to a minimum depth of 12 inches using manual spading shovels, forks and/or broadforks and working around major tree roots and/or utilities. In areas receiving new mulch, rip to a minimum depth of 4 inches while protecting any existing plants and their root system. Break up and/or remove rocks and clods as indicated below.

D. Do not work soil when moisture content is so great that excessive compaction will occur, or when it is so dry that dust will form in air or clods will not break up readily, or when a full ripping depth cannot be achieved. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and dust control. Maintain within 2 percent above or below optimum moisture content for the existing soil type at all times during the work.

E. After soil ripping and preliminary finish grading is completed, the topsoil shall be cleared of all concrete, wire, sticks, roots, debris and foreign materials. Remove native stones and clods as follows:
   1. In shrub/ground cover areas, remove stones and clods greater than one (1.0) inches in diameter from the top 3 inches of finish grade.
   2. In general, non-traffic turfgrass areas, remove stones and clods greater than three-quarter (0.75) inch in diameter from the top 3 inches of finish grade.

F. Add clean planting topsoil where needed to bring grade to elevation to promote positive drainage. Spread approved planting topsoil over ripped subgrade prior to incorporating amendments.

3.3 WEED CONTROL

A. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation.

B. The Contractor shall treat any weeds in proposed new turfgrass and planting areas with a post-emergent contact weed killer at manufacturer's approved rates prior to any commencement of work at the site including any irrigation work, ripping of soils or fine grading. Areas planned for turfgrass seed/stolon planting shall in addition receive “grow and kill” weed removal as outlined below.

C. Weed eradication shall be ongoing throughout the course of the landscape installation. The Contractor shall apply a pre-emergent herbicide after shrub/ground cover planting and prior to mulch installation. Manually remove weed seed heads. At no time will weeds be allowed to become established. Contractor shall provide all weed control operations as directed by the Owner’s Representative.

D. All weed control operations using pesticides/herbicides shall comply with the CalDPR and Owner Standards. The Contractor shall comply with the notification and posting requirements of the “Healthy Schools Act”.
   1. The Contractor shall notify the Owner per Subsection 1.11, A.
   2. The Contractor shall post highly visible signs around the treatment area in conformance with the “Healthy Schools Act” warning of a scheduled pesticide/herbicide application a minimum of 24 hours before to 72 hours after a pesticide application.

E. Just prior to turfgrass installation, and/or after the shrub/ground cover planting is complete and prior to mulch installation, apply an approved pre-emergent herbicide per the manufacturer’s recommended rates.

3.4 SOIL CONDITIONING

A. Before commencement of any soil conditioning, weed and rock removal shall be completed as outlined above.

B. Uniformly amend the entire area of topsoil in turfgrass and mixed planting areas per the following bid rates and per the approved modifications as a result of the soils analysis recommendations:
   1. Turf and Non-Sloped (less than 4h:1v) Planting Area Soil Conditioning (per 1,000 square feet).
      a. Compost at a rate of six (6.0) cubic yards (a 2.0 inch thick layer).
      b. Gypsum at a rate of 100 pounds, or Sulfur at 19 pounds, or an equivalent combination.
      c. Humate soil conditioner at a rate of thirty (30) pounds.
      d. A pre-planting fertilizer to turfgrass areas at a rate of 1.25 pounds of actual P and K.
      e. A pre-planting fertilizer to mixed planting areas at a rate of 1 pound of actual N.
      f. Endo 120 per Subsection 3.06, Mycorrhizae Application.

C. Till soil amendments into the entire planting area soil to a minimum depth of six (6) inches. Perform the cultivation in at least two passes, one in each perpendicular directions to the first, so that the amendments are homogeneously incorporated into the topsoil. All cultivation inside

the dripline of existing trees shall be preformed manually with minimal disturbance to the root system.

D. Planting backfill for trees and shrubs shall be a mix of four-fifths native soil and one-fifth Compost by volume. Add Humate and Endo 120 Mycorrhizae at 5 pounds each per cubic yard of backfill.

E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

3.5 FINE GRADING

A. Upon completion of soil preparation, fine grade all planting and turfgrass areas to a smooth and even slope conforming to and establishing drainage patterns per the approved Grading Plan. Grading shall eliminate all humps and hollows and promote positive drainage in all planting and turfgrass areas.

B. Where hardscape is installed in existing planting areas, a minimum transition grade width of 2 feet adjacent to the edge of hardscape shall be constructed unless noted otherwise. The maximum slope of any transition grade shall be 20 percent. The area of transition grading shall be planted or repaired as specified herein.

C. Tolerance of grade differential for planting and general turfgrass areas shall be plus or minus 0.04 foot. If requested, the Contractor shall water test all turf and planting areas after the grading operations are completed in the presence of the Owner’s Representative and Landscape Architect. The water test shall consist of applying water to the turf and planting areas to the point where water begins to run over the soil to show the drainage pattern. Make all corrections to the finish grading as required by the Owner’s Representative to re-established positive drainage patterns. Acceptance of the finish grading shall be obtained in writing from the Owner’s Representative and Landscape Architect prior to proceeding with soil conditioning and planting operations.

D. Turfgrass sports fields shall be fine graded using a laser controlled machine capable of producing final grades within 0.02 foot plus or minus from the proposed elevations.

E. After the finish grading process, relative compaction of the soil in turf and planting areas shall range between 82% and 85% relative density. Compaction/moisture levels are generally acceptable if an Oakfield probe is able to penetrate a minimum of six inches into the cultivated planting topsoil with moderate pressure. The Owner reserves the right to require the Contractor to test for over compaction. If the compaction is within the acceptable range, the test will be paid for by the Owner. All testing due to non-compliance will be paid for by the Contractor.

F. Remove all rocks produced as a result of the soil conditioning and finish grading operations per the requirements of Subsection 3.02.

G. Finish grades shall be one-half inch (1/2") to three-quarter inch (3/4”) for turfgrass sod areas, flush (0.0”) for turfgrass seed/stolon areas and two inches (2") for shrub/ground cover planting areas below the finish surface of all adjacent walks, curbs, mowstrips and utility/valve boxes or collars. Transition any grade modification in existing planted areas at a maximum 12h:1v slope to existing grade, unless shown otherwise on the grading plan.

3.6 MYCORRHIZAE APPLICATION

A. In turfgrass planting areas, after fine grading is completed broadcast Endo 120 Mycorrhizae at a rate of one and one half (1.5) pounds per 1,000 square feet (65 lbs. per acre). Lightly rake into the top one inch (1") of topsoil immediately prior to turfgrass installation.

B. In shrub and/or ground cover planting areas, the Mycorrhizae inocculant shall be incorporated into the soil with the other soil amendments at three (3.0) pounds per 1,000 square feet (130 lbs. per acre) per Subsection 3.04, Soil Conditioning. Innocculant shall also be incorporated into the planting backfill per Subsection 3.04, E.

3.7 PLANTING

A. General Requirements
   1. Obtain written approval from the Landscape Architect or Owner's Representative to begin planting operations. The irrigation system shall be fully automated and operational, all weeding, soil conditioning and finish grading completed, and the tree and plant layout approved.
   2. Planting shall be performed by workmen familiar with planting procedures and under the supervision of a qualified foreman. The planting foreman shall be on the job site al all times when planting is in progress.
   3. Planting operations shall not occur under unfavorable weather conditions.
   4. Boxed trees shall be planted first. Shrub planting shall be completed before groundcover is planted.
   5. Proceed and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of planting required.
   6. Cooperate with other contractors and trades working in and adjacent to the planting work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.

B. Planting Preparation and Operations
   1. Planting material shall be provided with adequate protection of root system and balls from drying winds and sun. Do not bend or bind trees or shrubs in such a manner as to damage bark, break or destroy natural shape. Provide protective covering during delivery.
   2. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately. If planting is delayed more than six (6) hours after deliver, set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist. Do not remove container grown stock from containers until planting time.
   3. All planting areas shall be smooth and even. Finish grades shall be done prior to any placement of plants.
   4. Place all trees and shrubs in locations shown on the planting plan and obtain written field approval of the Landscape Architect before planting or digging planting pits. Inform the Landscape Architect seven (7) days prior to placing the plants. Maintain a minimum 15 foot clearance from trees to any light pole, unless specifically noted otherwise.
   5. Carefully remove all canned stock from containers with tin snips or approved cutter. Cut away and remove any girdled or matted roots.
   6. Excavate holes of circular outline with vertical sides for all plants 15 gallon or less. Boxed trees shall have square planting holes. The vertical sides and bottom of the holes shall be thoroughly scarified to promote union of backfill with existing soils. All trees shall have two drainage sump holes drilled with a twelve inch (12") diameter auger

penetrating hardpan layers to a minimum one (1) foot into a sand/gravel layer or to a minimum depth of ten (10) feet below the planting pit bottom. Precautions shall be exercised to avoid smooth sides on the holes. Offset augured holes a minimum of eighteen inches (18") from planned tree location to avoid settling of tree after planting.

7. After cleaning out the sump holes, the Contractor shall test the sumps for drainage by flooding with water. If the water does not drain out within twenty-four (24) hours, auger down as required to achieve such drainage by breaking through the hardpan layer, or by extending the drainage sumps to a minimum depth of 15 feet below the bottom of the planting pit. After obtaining approval of the sump holes, fill the augured drainage sump holes with coarse concrete sand.
8. Tree and shrub planting pits shall be at least two and one half (2.5) times the width of the plant container, but a minimum of 36” wide for trees and 18” wide for container shrubs. Planting pits shall be as deep as the soil depth in the container or box, less the additional height of the crown above the finish grade.
9. Set each plant in the center of the pit, plumb and straight. Set the crown of the plant at one inch (1") for shrubs, two inches (2”) for trees above finish grade. When 1/2 of the backfill mix has been placed, tamp-in, insert fertilizer (BEST PAKS as per Section 2.1B1) and allow no air pockets as remainder of backfill is added.
10. Compact soil around the rootball of all plants and thoroughly water in the entire backfill depth.
11. Excess soil from plant holes shall be cultivated and raked to a smooth outline.
12. Shrubs and groundcovers shall be installed in relation to walks and paving to allow for future growth without obstructing traffic with clearance as shown on the drawings.
13. All plants shall be set in watering basin which shall be as wide as the planting pit, but at least four feet (4') in diameter and four inches (4") deep for trees and two feet (2') in diameter and three inches (3") deep for shrubs and vines.
14. Ground cover plants shall be planted at the spacing noted on the drawings. Not more than fifteen minutes shall elapse from the time any groundcover plant is planted until it is watered.

C. Pruning: Prune plants in accordance with established horticultural practice. Shearing of any plants will not be acceptable. Tree pruning shall only be performed with the written approval of the Landscape Architect and under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).

3.8 MULCH

A. Prior to any mulch application, perform weed control operations as specified herein.

B. Where mulch is to be installed in an existing planting area, breakup/till the existing soil in open areas around existing plantings to a minimum 4” depth per section 3.02, and adjust finish grade adjacent to hardscape elements per section 3.05 where not prohibited by existing plantings.

C. Install a minimum 3” layer of mulch in all non-turf planting areas, except for slopes greater than 3h:1v and seeded areas. Install a minimum 2” layer of mulch in all areas receiving flatted plants.

D. Install a minimum 3” layer of wood mulch at a minimum 3’ radius from the tree trunk of all trees located in turfgrass areas. Provide a smooth finish grade transition to a 2 inch depth where the mulch meets the turfgrass, so that the top elevation of the mulch is flush to the turfgrass soil. Keep mulch off the trunk. For new trees in turfgrass areas, remove the watering berm just

prior to the turfgrass planting but maintain the mulched area within the planting pit.

3.9 TURFGRASS SOD

A. The area to be planted shall be finish graded to present a smooth and even surface free of humps and hollows and conforming to the finish grading plans. Where new sod is abutting existing turfgrass, fine grade to allow for the thickness of the new sod soil so that the new and existing sod grades are flush. Immediately prior to planting, the surface of the area to be planted shall be sufficiently loose and friable, with adequate moisture to receive the sod. Avoid laying sod on hot or dry soil.

B. Lay first strip of sod slabs along a straight line (use a string in irregular areas). Butt joints tightly. Do not overlap edges. On second strip, stagger head joints (similar to a running bond brick pattern). Use a sharp knife to cut sod in order to fit curves, edges, and sprinkler heads.

C. Install with turf-tired machinery full width sections sod as delivered and flush to adjacent surfaces. Terminating sod edges shall be straight and at right angles to hardscape elements whenever possible.

D. As the sod is being installed, water the sod lightly to prevent drying out. Continue to lay sod and lightly water until installation is complete.

E. After laying sod, roll to eliminate irregularities and to form good contact between sod and soil. Avoid a too heavy roller or excessive initial watering which may cause roller marks.

F. Water the completed lawn surface thoroughly. Topsoil should be constantly moist for a minimum two inches deep. Repeat irrigating at regular intervals to keep sod moist until rooted. The areas shall not be watered to the extent of saturating the soil and causing "flotation" or "flowing" of the top surface of the soil. After water has once been applied, no portion of the planted areas shall be allowed to dry out during the entire maintenance period. After sod roots are established, decrease frequency and increase amount of water per application as necessary to maintain good soil moisture to a minimum 6” depth without standing water or excess runoff. The Contractor shall be responsible to monitor the site and alter the watering times and frequencies to meet site and climatic conditions.

G. Prior to the start of the maintenance period, fill all seam joint gaps greater than 1/8 inch and less than 0.5 inch with washed concrete sand. Fill any joint gaps of 0.5 inch or greater width with a minimum two foot long replacement sod section in order to achieve a tight joint.

H. Replace dead or distressed sod with equivalent material as directed by the Landscape Architect.

I. Do not install turfgrass inside the watering basin of new trees planted in turf areas, or within a 3’ radius of existing tree trunks located in turf areas.

3.10 CLEAN-UP AND REPAIR

A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to existing planting and structures. Disturbed and/or damaged areas, whether a part of this work or from the work of other trades, shall be restored to their original condition.

B. Plants and/or turfgrass shown to remain and damaged or removed by construction operations and/or utility/electrical/drainage lines shall be replaced with plants that match as closely as possible to the existing plant species, variety and size. The replacement turfgrass sod variety shall be the same as shown in the Planting Legend if for new work, or shall match the existing turfgrass variety where the turfgrass is existing. Adjust the finish grade so that the new turfgrass sod abuts flush to the existing turfgrass or to hardscape. The replacement plants and/or turfgrass sod shall be maintained as part of the original scope of work.

C. After the planting operations are completed, the Contractor shall remove all trash, excess soil, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired at the Contractor's expense and the site shall be left in a neat and orderly condition to the satisfaction of the Owner.

3.11 PRE-MAINTENANCE REVIEW

A. A general review will be held prior to the start of the maintenance period upon conclusion of the planting operations, irrigation system installation and after clean-up has occurred. The Owner’s Representative shall be informed in writing a minimum of seven (7) working days prior to the time the work is ready for review in order to arrange a suitable time and date for such review.

B. At the time of review, Contractor shall have all planting areas free of weeds and neatly cultivated and fine graded. All plant basins shall be in good repair. All trees shall be properly staked and tied. All turfgrass areas shall be fully established and have a healthy, uniform and dense stand of grass without weeds or bare spots.

C. Work requiring corrective action or replacement in the judgment of the Owner’s Representative shall be performed within five (5) days after the inspection. Corrective work and materials replacement shall be in accordance with the drawings and specifications and shall be made by the Contractor at no cost to the Owner. A subsequent review shall then be arranged.

D. If after the review, the Landscape Architect is of the opinion that all the work has been performed as per the Contract Documents, and a uniform stand of healthy dense turfgrass has been established without weeds or bare spots, the Contractor will be given written notice that the maintenance period may begin.

3.12 MAINTENANCE - GENERAL

A. After all work indicated on the drawings or herein specified has been completed, reviewed, and approved, and the turfgrass has been successfully established per the requirements below, the Contractor shall commence a sixty (60) calendar day maintenance period in which the Contractor shall continuously maintain all areas included in the contract during the progress of the work and throughout the maintenance period, or until Final Acceptance of the project, whichever is greater.

B. Maintenance work includes monitoring the site to control all watering, replanting, fertilizing, mulching, weeding, cultivating and mowing necessary to bring the planted areas to a healthy and vigorous growing condition, and any additional work needed to keep the areas neat, edged, weed and trash free, and attractive.

C. All trees, shrubs, ground cover shall be kept at optimum growing condition by watering weeding, replanting, fertilizing, cultivating, tree stake repair, spraying for diseases and insects, replace dead or dying materials, pruning as directed, maintaining proper grades of plants, and providing any other reasonable operations of maintenance and protection required for successful completion of the project.

D. Any date when the Contractor fails to adequately water, replace unsuitable planted areas and other work determined to be necessary by the Owner, will **NOT** be credited as part of the establishment/maintenance period.

E. The establishment of turfgrass seed/stolons is herein defined as being all work necessary to germinate the planted turfgrass and grow a full, healthy, uniform stand of smooth and even texture and grade with clean straight edges without weeds or bare spots, and has been mowed at least twice per Subsection 3.17. The establishment of turfgrass sod is herein defined as being all work necessary to develop sod without weeds or distressed areas with a minimum rooting depth of 2 inches into site soil.

F. No additional payment will be made for additional time necessary for turfgrass establishment. The maintenance period shall not start until all contract work has been completed and all close-out documents and materials have been submitted. Turfgrass will be considered weed-free if there is a maximum of one percent undesirable turfgrass species, and nine weeds or less per 50 square yards (one per 50 square feet).

G. During the progress of the maintenance period, the Contractor and the Owner's Representative shall conduct reviews at no less than 21 day intervals to determine that ongoing maintenance activities have been conducted by the Contractor. If in the opinion of the Owner, ongoing maintenance has not been conducted by the Contractor in a satisfactory manner the maintenance period shall be suspended. The Contractor shall provide remedial work as directed by the Owner's Representative to correct the found deficiencies and schedule another review. If after the subsequent review the work is deemed acceptable, the maintenance period shall resume.

3.13 MAINTENANCE – MOWING AND DRESSING

A. For new sod, mow when 1.125 inch tall and cut down to 0.75 inch.

B. Turfgrass areas shall be mowed during the growing season a minimum of twice a week for warm-season varieties and a minimum of once a week for cool-season varieties, or at any time the grass reaches 1.4 times its mowing height. Turfgrass shall be edged weekly. The Contractor shall coordinate his watering and weed control schedules to accommodate his mowing schedule. If the Contractor is unable to mow the turf areas on the required day, he has until 5:00 pm of the next day to do the work. After that time, the Owner reserves the right to secure the services of an alternate mowing entity to perform the work. The cost for the alternate mowing will be deducted from monies owed to the Contractor. The Contractor will remain responsible to perform all scheduled mowings and maintenance of the site. The turfgrass shall be mowed and edged, and all trash and debris removed prior to Final Acceptance.

3.14 MAINTENANCE - FERTILIZATION

A. The Contractor shall fertilize the warm-season turfgrass (Bermudagrass) at the start of the maintenance period and every twenty-eight (28) days with the turfgrass maintenance fertilizer at a rate of 0.75 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall continue the fertilizer applications until the established turf is accepted.

B. The Contractor shall fertilize the temporary cool-season turfgrass at the start of the maintenance period every twenty-eight (28) days with the turfgrass maintenance fertilizer at a rate of 0.5 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall continue the fertilizer applications until the established temporary turf is accepted.

C. The Contractor shall fertilize the turfgrass areas during the last week of the maintenance period with the turfgrass maintenance slow-release N fertilizer (43-0-0) at a rate of three and one-half (3.5) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect.

D. The Contractor shall fertilize the non-turf planted areas during the last week of the maintenance period with the mixed pre-planting fertilizer (14-6-11.6) at a rate of six (6.0) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect.

3.15 MAINTENANCE – REPAIR AND WEEDING

A. Between the twenty-first (21) day and the twenty-eigth (28) day after turfgrass planting, the Contractor shall perform the following: replant all spots or areas where normal germination or growth is not evident; remove all rocks or other debris that would constitute a hindrance to mowing or cultivating; repair all damage done by his operations. Where poorly compacted trench backfill shows settlement, remove turfgrass or plants, fill all depressions and eroded channels with sufficient conditioned topsoil to raise to proper grade, compact lightly and replant the filled areas. Roll all planted or replanted turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface.

B. Visible weeds shall be removed at least weekly during the maintenance period. At the end of the maintenance period, all planting areas shall be without weeds. If weeds are present, the Contractor shall manually remove the weeds and shall then apply a granular, selective pre-emergent herbicide at manufacturer's approved rates. Coordinate application with the Owner’s Representative and provide certificates of application to Owner’s Representative. The turfgrass will be considered weed-free if there are 9 weeds or less per 50 square yards (one per 50 square feet).

3.16 FINAL REVIEW

A. A Final Review will be made before the end of the Maintenance Period or upon the pending Final Acceptance of the work, whichever is earlier, provided all deficiencies revealed during the maintenance period have been corrected. If these deficiencies have not been corrected by the end of the stated maintenance period, the Contractor shall continue to fully maintain the project at his own expense. After all deficiencies have been corrected, a Final Review will be held with the Landscape Architect, Owner’s Representative, and Contractor.

B. If after the Final Review, the Landscape Architect and Owner's Representative are of the opinion that the work is acceptable and complete, the Contractor's maintenance responsibility shall terminate on an agreed upon date.

3.17 WARRANTY AND REPLACEMENT

A. All trees and plants provided under this Contract shall be guaranteed to be in good, healthy, disease/pest free and in a flourishing condition one growing year from the date of Final Acceptance of the work, provided the Owner maintains the plants properly and in accordance with accepted horticultural practices. Species and size of any tree and/or plant replacements, either prior to or after Final Acceptance, shall be equal to that of the same adjacent trees and/or plants at the time of replacement as determined by the Landscape Architect.

B. The Contractor shall be responsible to replace all lost plants due to theft, vandalism or any other preventable causes till Final Acceptance of the work by the Owner. Replacement trees and plants shall be planted as originally specified and detailed. Replacement trees and plants shall be guaranteed as specified above from the date of replacement. The maintenance period may be extended for a duration of not more than the original maintenance period duration for the establishment of replacement plants.

C. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects or actions of trees, plants, materials, equipment or workmanship one year from the date of Final Acceptance or the Notice of Completion, whichever is later.

END OF SECTION