SECTION 26 2800
LOW VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal Magnetic Molded Case Circuit Breakers.
2. Electronic Trip Molded Case Circuit Breakers.
3. Fusible switches and fuses.

1.2 REFERENCES

A. The circuit breaker(s) referenced herein shall be designed and manufactured according to the latest revision of the following standards.

1. ANSI/NFPA 70 - National Electrical Code (NEC).
2. NEMA AB 1 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches.
3. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures.
4. UL 943 - Standard for Ground Fault Circuit Interrupters.
5. UL 1053 – Ground Fault Sensing and Relaying Equipment.
6. CSA C22.2 No. 5 - (Canadian Standard Association) Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures.
7. Federal Specification W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
8. Federal Specification W-C-865 - Fusible Switches.
9. IEC 60947 – Low Voltage Switchgear and Control Gear – Part 2: Circuit Breakers.
10. IEC 61000-4 Series – Electromagnetic Compatibility.

1.3 SYSTEM DESCRIPTION

A. Provide overcurrent protective devices as specified herein and as shown on schedules and/or drawings.

1.4 SUBMITTALS

A. Provide submittals for products in accordance with Section 26 0000 - Electrical General Requirements and Division 1.

B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Submit product data for each type of overcurrent protective device, ground fault protector, accessory, and component indicated. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Provide outline drawings with dimensions, and ratings for voltage, amperage and maximum interruption. Include instructions for circuit breaker mounting, trip unit functions and adjustments, trouble shooting, accessories and wiring diagrams.

D. Coordination data to check protective devices: Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and Ip & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.

E. Provide information required to verify compliance with the short circuit withstand and interrupting ratings, as shown on the Drawings or further stated in these Specifications.

1.5 QUALITY ASSURANCE

A. Devices shall be the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with applicable standards and UL listings.

B. Nationally Recognized Testing Laboratory (NRTL) Labeling: Electrical equipment and conductors installed in the State of Alaska must be “Approved,” “Certified,” “Identified,” or “Listed” and “Labeled” to establish that the electrical equipment is safe, free of electrical shock and fire hazard, and suitable for the purpose for which it is intended to be used. The manufacturer shall have the specific authorization of one of the Occupational Safety and Health Administration (OSHA) approved Nationally Recognized Testing Laboratories (NRTLs) in accordance with the applicable national standards to label the equipment as suitable.

C. The overcurrent protection device manufacturing facility shall be Registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9000 Series Standards for quality.

PART 2 - PRODUCTS

2.1 PRODUCT

A. The existing panel boards are equipment from Cutler-Hammer.

2.2 MOLDED CASE CIRCUIT BREAKERS

A. General Characteristics:

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle, and the accessory mounting area.
2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which shall provide quick make, quick break contact action. The circuit breaker shall have common tripping of all poles.
3. The circuit breaker handle shall reside in a tripped position between on and off to provide local trip indication. Circuit breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings.
4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
5. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes (except Type QO/EDB/EGB/EJB).
6. MCCBs shall be able to receive a device for locking in the isolated position. MCCBs that serve as the main service disconnect shall be provided with a device for locking in the isolated position.
7. Electronic components shall withstand temperatures up to 221°F (105°C).

8. Circuit breakers shall be UL listed to accept field installable/removable mechanical type lugs (except Type (except Type QO/EDB/EGB/EJB/QB/QD/QG/QJ).
9. Lugs shall be UL listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 75°C rated wire or 90 C rated wire, sized according to the 167°F (75°C) temperature rating in the NEC.
10.

B. Trip Unit:
   1. General:
      a. Circuit breakers with permanent trip units shall be UL listed for reverse connection without restrictive line and load markings and shall be suitable for mounting in any position.
      b. The trip units shall not augment overall circuit breaker volume.
   2. Thermal Magnetic
      a. Basis of Design: Cutler Hammer
         1). General:
            a) Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true RMS sensing and thermally responsive to protect circuit conductor(s) in a 104 F (40 C) ambient temperature. Circuit breaker frame sizes above 150 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker

C. Accessories:
   1. General:
      a. Circuit breakers shall be equipped with UL listed electrical accessories as noted on the Drawings or schedules or they may be field installable.
      b. The addition of auxiliaries shall not increase the volume of the circuit breaker.
   2. Handle Accessories:
      a. Provide circuit breaker handle accessories required for locking handle in the on and off position.

D. .

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings. Install circuit breakers in accordance with manufacturer's instructions, the National Electrical Code and applicable local codes.

B. Size devices as shown and specified, or as required by the load being served.

3.2 ARC FLASH LABELING

A. Provide arc flash labels for equipment that provides all of the following:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
    a. Available incident energy level or arc flash PPE Category in NFPA 70E, Standard for Electrical Safety
    b. Minimum arc rating of clothing
    c. Site specific level of PPE

END OF SECTION 26 2800

SECTION 26 2816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general requirements, products, and methods of execution relating to fusible and non-fusible disconnecting devices approved for use on this project.

B. Related Sections:

1. 26 0519 - Low Voltage Electrical Power Conductors and Cables
2. 26 0526 - Grounding and Bonding for Electrical Systems
3. 26 0529 - Hangars and Supports for Electrical Systems
4. 26 0553 - Identification for Electrical Systems

1.2 SUBMITTALS

A. Provide submittals for products in accordance with Section 26 0000 - Electrical General Requirements and Division 1.

1.3 QUALITY ASSURANCE

A. Devices shall be of the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with U.L. listings and the governing NEMA standards.

B. Disconnects shall be of the same manufacturer as switchboards and panelboards.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Safety switches, fusible and non-fusible, shall conform to NEMA Standard KS1 for type HD (Heavy Duty) unless otherwise noted.

1. Switch Interior: Switches shall have switch blades that are fully visible in the OFF position when the door is open. Switches shall be of dead front construction with permanently attached arc suppressers. Lugs shall be UL listed for copper and/or aluminum cables and be front removable.
2. Switch Mechanism: Switches shall have a quick-make and quick-break operating handle and mechanism that shall be an integral part of the box, not the cover. Switches shall have a defeatable dual cover interlock to prevent unauthorized opening of the switch door in the ON position or closing of the switch mechanism with the door open. The switch shall be capable of being locked in the OFF position with three (3) padlocks.
3. Enclosures: Switch enclosure shall be suitable for the environment in which the switch is mounted. NEMA 1 enclosure shall be code gauge, UL-98, sheet steel, treated with a rust inhibiting phosphate and finished in gray, baked enamel. NEMA 3R enclosure--same requirements as NEMA 1 except galvanized prior to painting.
4. Rating: Ampere, volt and horsepower ratings, as well as number of poles and presence of neutral bar shall be shown on the nameplate.

2.2 CIRCUIT BREAKERS

A. Circuit breakers used as disconnects shall meet requirements specified in Section 26 2800 – Low Voltage Circuit Protective Devices. Enclosures for same shall meet the requirements as specified above.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate details pertaining to size of motor and/or equipment, location and requirements to enclosure, ratings, etc., so as to provide the most suitable unit for the intended purpose.

B. Provide nameplates for disconnects. Coordinate names with mechanical equipment lists.

C. Where the rating of a fused disconnect exceeds the ampacity of the conductors being protected, a permanent label noting maximum fuse size shall be installed in a conspicuous location within the switch.

D. Where recommended or required by the equipment manufacturer, or required by underwriters' laboratories, disconnects shall be the fusible type, fused in accordance with the equipment nameplate information.

E. Provide code required disconnects. For equipment under the jurisdiction of the IMC, provide a disconnect within sight of the equipment.

END OF SECTION 26 2816

SECTION 26 2900
LOW VOLTAGE CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general requirements, products, and methods of execution relating to manual and magnetic motor starters provided in this and other Divisions. Overloads shall be furnished and installed in Divisions 26, 27 and 28.

B. Related Sections:

1. 26 0553 - Identification for Electrical Systems

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
5. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
6. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Provide submittals for products in accordance with Section 26 0000 - Electrical General Requirements and Division 1.

1.4 QUALITY ASSURANCE

A. Equipment shall be of the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with the governing standards.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. The Basis of Design is equipment from Square D by Schneider Electric to set a standard for quality. Equipment from alternative systems will be considered providing that sufficient documentation is provided to satisfy the CONTRACTING AGENCY that the equipment meets the requirements of the Specifications, and matches the Basis of Design on all points which are pertinent to the Project.

2.2 AC FRACTIONAL MANUAL STARTERS

A. The manual starter shall consist of a manually operated toggle switch equipped with red pilot light and melting alloy type thermal overload relay.

B. Thermal unit shall be one piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed.

2.3 **AC MANUAL STARTERS--LINE VOLTAGE TYPE**

A. Manual starters shall be constructed and tested in accordance with the latest published NEMA standards.

B. The manual starters shall consist of a manually operated switch equipped with red pilot light and melting alloy type thermal overload relays in every phase conductor. Thermal units shall be one piece construction and the starter shall be inoperative if any thermal unit is removed.

C. Starters shall be furnished in a NEMA 1 general purpose enclosure unless otherwise indicated on the plans or required by the conditions of the area in which they are installed.

2.4 **AC MAGNETIC STARTERS--LINE VOLTAGE TYPE**

A. Motor starters shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes and horsepower ratings.

B. Starters shall be mounted in NEMA 1 general purpose enclosures unless otherwise indicated on plans or required by the conditions of the area in which they are installed.

C. Starters shall be furnished with overload relays in every phase conductor and starters shall be inoperative if any overload unit is removed.

1. Overload relays shall be bimetallic type. Thermal units shall be of one-piece construction and interchangeable.

D. Starters through NEMA size five (5) shall be equipped with double break silver alloy contacts. Contacts shall be replaceable without removing power wiring or removing starter from panel.

E. Coils shall be of molded construction and shall be 120 VAC. Starters shall have a fused 120V control power transformer in enclosure, or alternatively on 120/208 or 120/240 volt systems, the power system neutral conductor may be utilized. In all cases, control power shall be disconnected by the starter disconnecting means, unless otherwise specifically approved.

F. Starters shall be suitable for field addition of at least four (4) auxiliary electrical interlocks of any arrangement, normally open or normally closed.

G. Starters shall have enclosure mounted red running pilot light and Hand-Off-Auto switch.

2.5 **AC COMBINATION STARTERS WITH FUSIBLE DISCONNECT SWITCH OR CIRCUIT BREAKER**

A. Combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes and horsepower ratings.

B. Disconnect switch combination starters shall consist of a visible blade disconnect switch and a motor starter.

C. Combination starters shall be mounted in NEMA 1 general purpose enclosures unless otherwise indicated on the plans or required by the conditions of the area in which they are installed.

D. The disconnect handle used on combination starters shall always be in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "on" or "off".

E. Magnetic starters provided under all Divisions of the Specifications shall be in accordance with this Section.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate details pertaining to the motor control equipment with the Division of these specifications where the equipment is specified.

3.2 CONTROL WIRING

A. Control wiring and control devices shall be provided under the Specification Division in which the controlled equipment is specified. Coordinate all related work.

3.3 CONNECTIONS

A. Provide liquid tight flexible conduit connections to motors and other equipment subject to vibration where LFMC is an acceptable wiring method. Provide flexible conduit connections to motors and other equipment subject to vibration that is located in spaces used for environmental air (e.g. fan rooms). Minimum length 12 inches.

3.4 NAMEPLATES

A. Provide engraved nameplates for all starters in accordance with Section 26 0553 – Identification for Electrical Systems. Coordinate names with mechanical equipment lists.

3.5 REDUCED VOLTAGE STARTERS

A. Reduced voltage starters shall be provided for all motors larger than:

208 volts	25 horsepower

1. This requirement shall apply to starters furnished in this Division and other Divisions of the specifications.
2. Motors controlled by Variable Frequency Drives (VFDs) are not subject to this requirement.

3.6 TWO SPEED STARTERS

A. Provide two speed starters for all two speed motors. Starters shall comply with the requirements of the equipment and motor manufacturers. Refer to Mechanical Equipment Lists for equipment with two speed motors.

B. This requirement shall apply to starters furnished in this Division and other Divisions of the specifications.

END OF SECTION 26 2900

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 2916
ENCLOSED CONTACTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General purpose contactors.
2. Lighting contactors.

B. Related Sections:

1. 26 0553 - Identification for Electrical Systems

1.2 REFERENCES

A. ANSI/NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

B. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.

C. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

D. ANSI/NFPA 70 - National Electrical Code.

1.3 QUALITY ASSURANCE

A. Contactors shall be of the latest approved design as manufactured by a nationally recognized manufacturer and be Underwriters' Laboratory listed and bear the UL label.

B. Contactors of each type provided shall include the features as indicated on the Drawings.

1.4 SUBMITTALS

A. Provide submittals for products in accordance with Section 26 0000 - Electrical General Requirements and Division 1.

B. Submit for approval manufacturer's shop drawings to show dimensions, features, accessories, enclosures, mounting arrangements, interconnecting diagrams, schedules of all overcurrent devices, voltage ratings, and specified accessories.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of each contactor and indicate circuits controlled.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. The Basis of Design is equipment from Square D by Schneider Electric to set a standard for quality. Equipment from Cutler-Hammer/Westinghouse (Westinghouse design products only), Seimens Energy & Automation, General Electric, or alternative systems will be considered providing that sufficient documentation is provided to satisfy the CONTRACTING AGENCY that the equipment meets the requirements of the Specifications, and matches the Basis of Design on all points which are pertinent to the Project.

2.2 CONTACTOR FEATURES - GENERAL

A. Enclosures:

1. For other than Panelboard Lighting Contactors, enclosures shall be ANSI/NEMA ICS 6, Type [1] [3R] [4] [12] as indicated or as required to meet conditions of the installation. Panelboard Lighting Contactors shall be mounted within the Panelboard.

B. Accessories:

1. Provide the following accessories as indicated for each contactor:

   a. Pushbutton: ON/OFF. NEMA ICS 2, heavy duty type.

   b. Selector Switches: ON/OFF or HAND/OFF/AUTOMATIC. NEMA ICS 2, heavy duty type.

   c. Indicating Lights: NEMA ICS 2, push-to- test type.

   d. Auxiliary Contacts: field convertible, quantity indicated.

   e. Other: as indicated.

C. Coil Voltages: 120 volts, 60 Hz, or as indicated for each contactor.

D. Poles: As indicated or required for the specific application.

E. Contact Rating: as indicated or as required to meet conditions of the installation.

F. Size: As indicated or required by the load.

G. Configuration: Provide types as indicated:

1. Electrically held shall have continuously rated, encapsulated coils.

2. Mechanically held shall be electrically operated with encapsulated coils. Standard coil clearing contacts shall be provided so that the contactor coils shall be energized only during the instance of operation.

2.3 GENERAL PURPOSE CONTACTORS

A. Square D Company - 8502 Type S.

B. Description: NEMA ICS 2, AC general purpose magnetic contactor.

C. Coil: encapsulated type.

D. Contacts: Totally enclosed, double break silver cadmium oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

E. Wiring: Straight through wiring with terminals clearly marked.

2.4 **MULTIPOLE LIGHTING CONTACTORS**

A. Square D Company - 8903 Type L & LX.

B. Description: magnetic lighting contactor.

C. Contact Rating: 20 amperes for all types of ballast and tungsten lighting, resistive heating, and motor loads.

D. Contacts: Totally enclosed, double break silver cadmium oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contacts shall have clearly visible N.O. and N.C. contact status indicators.

E. Wiring: Straight-through wiring with all terminals clearly marked.

PART 3 - EXECUTION

3.1 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

3.2 **SCHEDULE**

A. Refer to the Drawings for Contactor requirements.

3.3 **NAMEPLATES**

A. Provide engraved nameplates for Contactors in accordance with Section 26 0553 – Identification for Electrical Systems.

END OF SECTION 26 2916

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 5000
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes general requirements, products and methods of execution relating to lighting fixtures lamps, ballasts, LEDs, LED drivers and related products approved for use on this project.

B. The Fixture Schedule is a general guide to type, quality and other characteristics. Fixtures of equal or better performance and quality may be substituted, subject to approval.

1.2 RELATED SECTIONS

A. 26 2726 - Wiring Devices

B. 26 0943 – Networked Lighting Controls

1.3 QUALITY ASSURANCE

A. The fixture shall be a standard catalog item as described on the Drawings and as made by a nationally recognized manufacturer.

B. Lamps specified in this Section shall be as manufactured by Osram Sylvania, Philips, General Electric or Venture.

C. LEDs specified in this Section shall be as manufactured by Nichia, Samsung, or Cree.

D. Ballasts specified in this Section shall be as manufactured by Osram, Advance, or Universal, unless noted otherwise.

E. Drivers specified in this Section shall be as manufactured by Osram, GE, Advance, Phillips or endoLED, unless noted otherwise.

1.4 SUBMITTALS

A. Provide submittals for all products in accordance with Section 26 0000 and Division 1.

B. Fixture mounting shall be clearly identified on submittal information and coordinated with architectural, features, assemblies, details and reflected ceiling plan.

C. Fixtures and poles with color selections shall have color chips submitted for final color selection by Architect.

D. Lamps, ballasts, LEDs, LED Drivers and related products are generally included in the fixture schedule on the plans. Verify that the fixture types submitted for approval contain components complying with the product specifications of this Section.

1.5 SHOP DRAWINGS

A. Provide fabrication drawings that indicate fixture, type, kind, weight, lamp, LEDs, ballast, LED drivers, method of fitting and fastening parts together, location and number of sockets, and complete details of method of fitting suspension and fastening fixtures in place. Verify fixture dimensions with construction conditions prior to ordering fixtures.

B. Provide wiring diagrams that indicate supply power and interconnections for lighting controls, equipment and light fixtures. Provide sufficient information to assemble and install equipment at the project site without further instructions.

1.6 **WARRANTY**

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Interior lighting fixtures: 36 months from date of Substantial Completion.
2. Exterior lighting fixtures and poles: 60 months from date of Substantial Completion.
3. Controls mounted on or integral to lighting fixtures: 60 months from date of Substantial Completion.
4. Lamps: 24 months from date of Substantial Completion.
5. Ballasts: 60 months from date of Substantial Completion.
6. LEDs and LED Drivers: 60 months from date of Substantial Completion.
7. Emergency Battery Ballasts and Drivers: 60 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 **GENERAL**

A. Provide fixtures in conformance with the Fixture Schedule, with all required flanges and supports. Lighting fixtures shall be provided complete with all suspension, trim, mounting, and operating accessories normally considered necessary for a complete, functional, and safe installation, whether specifically called for in the Contract Documents or not.

2.2 **LINEAR SYSTEMS**

A. Linear fixture systems shall be provided with all corners, transitions, adjustable sections, custom angles, etc., to provide continuous linear systems. These features shall be provided to center the lamp cavity(s) of the fixtures within the designated mounting space(s) (typically wall-to-wall).

2.3 **LIGHT EMITTING DIODE (LED) FIXTURES**

A. LED fixtures shall comply with Illuminating Engineering Society (IES) LM-79 guidelines.

B. Fixture shall have an LM-79 photometric test report from a DOE CALiPER NVLAP accredited laboratory.

C. Fixture shall utilize components (i.e. LEDs, driver, fixture housing, etc) included in LM-79 test.

D. Fixture shall have lumen maintenance testing with minimum test duration of 10,000 hours.

E. Manufacturer stated end of life shall be at 70% light output. Operating life shall be no less than 50,000 hours.

F. Color temperature, and color rendering index (CRI) shall conform to the lighting fixture schedule shown on the Drawings.

G. Fixture power factor shall be greater than 0.9 over all input voltages.

H. Total Harmonic Distortion (THD) shall be less than 20% over all input voltages.

I. Fixture components shall be lead free, mercury free and RoHS compliant.

2.4 FULLY RECESSED FIXTURES

A. Fixtures shall have thermal protection conforming to NEC and shall so be identified as thermally protected unless fixture is:

1. Identified for use and installed in poured concrete, or
2. Identified as suitable for installation in cavities where the thermal insulation will be in direct contact with the fixture.

2.5 FLUORESCENT LAMPS

A. Lamp type, color temperature, and color rendering index (CRI) shall conform to the lighting fixture schedule shown on the Drawings.

B. To the extent that they are commercially available all fluorescent lamps shall be low mercury type. Low mercury lamp types shall meet the requirements for classification as non-hazardous waste when subjected to the Toxic Characteristic Leaching Procedure (TCLP) prescribed by the Environmental Protection Agency at end of life and shall be clearly identifiable from other lamp types.

2.6 LIGHT EMITTING DIODES (LEDS)

A. LEDs shall comply with Illuminating Engineering Society (IES) LM-80 guidelines.

B. Manufacturer stated lamp end of life shall be at 70% light output. Lamp operating life shall be no less than 50,000 hours.

2.7 BALLAST/DRIVER DISCONNECTING MEANS

A. In indoor locations, luminaires that ballasts(s) or LED Driver(s) shall have a disconnecting means either internal or external to each luminaire to disconnect simultaneously from the source of supply all conductors of the ballast and LEDs/LED boards, including the grounded conductor in accordance with National Electrical Code (NEC) Article 410.

2.8 LED DRIVERS

A. LED drivers – Non Dimming

1. Input: 120-277V, 50/60Hz (100-305V with tolerances)
2. Frequency: 47 - 63Hz
3. Efficiency: >90% at full load at nominal working voltage
4. Power Factor: >0.9 over all input voltages
5. Total Harmonic Distortion: <20% overall all input voltages
6. Output: Class 2 LED/55V max, Current range (adjustable) 150mA to 1,400mA
7. UL recognized
8. Phillips, GE, Osram, eldoLED or approved equal.
9. Drivers and controls shall be compatible.

B. LED drivers – Dimming

1. Input: 120-277V, 50/60Hz (100-305V with tolerances)
2. Frequency: 47 - 63Hz
3. Efficiency: >90% at full load at nominal working voltage

4. Power Factor: >0.9 over all input voltages
5. Total Harmonic Distortion: <20% overall all input voltages
6. Output: Class 2 LED/55V max, Current range (adjustable) 150mA to 1,400mA
7. Flicker-free dimming down to 1% with full on/off.
8. 0-10V drive compatible with both sink and current source controllers.
9. UL recognized
10. Phillips, GE, Osram, eldoLED or approved equal.
11. Drivers and controls shall be compatible.

2.9 EMERGENCY LIGHTING DRIVER – LED

A. Provide emergency lighting ballasts for LED fixtures with the following features:

1. Shall be capable of operating at the minimum lumen output specified in the Table below for a minimum of 90 minutes:

Fixture Type	Normal Lumen Output of Fixture	Minimum Lumen Output of Fixture in Emergency Mode	Manufacturer Model P/N	Remote Mounting
Type X	4800	900	Bodine BSL17C	Yes or No
Type Y	3000	600	Bodine BSL17C	Yes or No
Type Z	4800	1900	Bodine BSL20	Yes or No

2. Universal input (120-277 VAC)
3. Compatible with the LED fixture and driver intended for use with.
4. High-temperature long-life, nickel cadmium battery. Electronic charger with 24 hour or less recharge time.
5. Charge indicator lamp and test switch, with lamp visible, and test switch accessible, without opening fixture.
6. Equipped with self-testing/self-diagnostic circuitry.
7. UL listed.
8. When used with dimmable drivers/fixtures circuity/programming to restore light output to specified lumens in emergency mode shall be provided.
9. Bodine BSL Series or Equal.

2.10 FIXTURE ACCESSORIES

A. Canopies for pendant hung fixtures shall be of the ball joint type. Where more than one pendant is used per fixture, as in the case of fluorescents, a ball joint fitting shall also be provided in the fixture end of each pendant.

B. Furnish one tamperproof screwdriver of each type of tamperproof fixture as required by fixtures specified on this project.

PART 3 - EXECUTION

3.1 GENERAL

A. Ballasts and Drivers shall be installed per manufacturer's recommendations.

B. Fixtures with integral ballasts and Drivers shall have the ballast or driver installed and prewired at the factory.

C. Tandem wiring harnesses internal fixture wiring shall be factory assembled and installed in multiple fixtures which share a common ballast or driver. All wiring harnesses shall include an integral copper grounding conductor and be approved for use in air plenums.

3.2 INSTALLATION

A. Install fixtures level, plumb and true. Align rows accurately in three dimensions.

B. Support suspended acoustical ceiling fixtures according to the requirements of the IBC and Section 26 0529 and Section 25 0548 – Mechanical Vibration and Seismic Control as well as any local amendments.

C. Fixture pendants, canopies, blank sections, corners, tees and other such accessories shall be finished to match their respective fixture.

D. Refer to applicable details on architectural drawings for specific mounting requirements for all fixtures with special mounting requirements such as cove-mounted fixtures and linear fixtures.

E. For linear fixture systems, verify fixture dimensions and mounting type with other trades prior to installation.

F. Utility Rooms: Surface ceiling mount fixtures in rooms/areas with ceilings. In areas without ceilings pendant fixtures down to bottom of structure. In areas with mechanical equipment, ductwork and piping, pendant fixtures down to bottom of mechanical ductwork or piping as appropriate. Fixture pendants shall be rigid (threaded hangar rods) and shall be sway braced where pendants exceed 24 inches in length.

G. Provide an unswitched circuit connection for the following:

1. Exit signs
2. Emergency lighting units (ELUs)
3. Emergency fixtures
4. Emergency night lights
5. Fixtures with emergency battery ballasts or LED drivers

H. Wiring for fixtures connected to emergency circuits shall be kept entirely independent of other wiring and equipment in accordance with NEC article 700.

I. Clean all fixtures and lenses prior to final acceptance.

3.3 FIRE-RESISTIVE CONSTRUCTION

A. Refer to Section 26 0000 Electrical General Requirements.

3.4 EXTERIOR FIXTURES

A. Exterior fixtures, supports and pole assemblies shall be capable of withstanding 100 mph winds with gusts to 130 mph with no damage. Where the Contracting Agency or any regulatory agencies require higher values for these, the more stringent requirements shall apply.

B. Anchor Bolts: Provide the quantity and type of anchor bolts required by the pole manufacturer. Provide flat-washers, lock-washers and hexagonal nuts. Provide template for positioning anchor bolts. All anchor bolts shall be hot dip galvanized.

C. Poles:

1. Non-anodized poles shall be factory painted with polyester powder coat. Touch up all damage to paint.

2. Anodized aluminum poles shall be finished with an Aluminum Association Architectural Class 1 anodized finish.

END OF SECTION 26 5000

SECTION 27 2010
TELECOM DISTRIBUTION SYSTEM (TDS)

PART 1 - GENERAL

1.1 DESCRIPTION AND GENERAL SPECIFICATIONS

A. Provide the equipment, materials, and labor to install the systems shown on the Drawings and specified herein. This shall include (but not be limited to) provision of all trenching and backfill, raceways, sleeves, boxes, gutters, shelves, enclosures, shelf and enclosure supports, backboards, equipment racks, line and low voltage wire and cable, patch cords, pull ropes (in unused conduits), terminal modules, panels, outlets, jacks, splices, connections, cable management, labeling, testing and all other material, equipment, and labor required to make the systems fully operational.

B. The intent of this Specification is to place in working order a complete, fully tested and documented Category 5e system complying with the Codes and Standards referenced herein.

1.2 RELATED SECTIONS

A. 26 0533 - Raceway and Boxes for Electrical Systems

1.3 COORDINATION

A. The necessity to coordinate this work with the Serving Utility, Owner and the Contracting Agency is emphasized. The Contractor shall be responsible for any omissions, delays and additional cost due to lack of coordination or approval from the same.

B. Coordinate work with other contractors and trades. The layout and installation of the systems shown on the Drawings and specified herein shall be coordinated such that all special requirements for telecommunications systems shall be provided and incorporated into the project. The systems to be coordinated shall include (but are not limited to) electrical raceway, grounding, fire rated assembly, lighting, power distribution, control and instrumentation, and labeling of cables, terminations, outlets, jacks, etc. Report all conflicts to the Contracting Agency.

C. Downtime for existing systems shall be minimized. It is the responsibility of the Contractor to plan, coordinate, and execute installation activities so that facilities are not unduly interrupted. Periods of unavoidable interruption shall be less than 4 hours in duration and be prior approved by the Contracting Agency.

1.4 CODES AND STANDARDS

A. Where a Nationally Recognized Testing Laboratory (NRTL) listing or classification exists for a product and the product is suitable for the purpose specified and indicated, the product shall bear the appropriate marking indicating the listing or classification.

B. Where a UL Standard is in effect, equipment shall:

1. Meet that Standard.
2. Bear the UL Label.

1.5 SUBMITTALS

A. The following shall be submitted in accordance with Section 26 0000 - Electrical General Requirements and Division 1 in sufficient detail to show full compliance with the specification:

1. Manufacturer's Catalog Data shall be submitted for the following items. Data shall include a complete list of parts, special tools, and supplies.
    a. Copper Cable.
    b. Splice Cases.
    c. Information Outlets.
    d. Patch Panels.
    e. Equipment Racks.
    f. Terminal Modules.
    g. Patch Cords and other accessories.
2. Manufacturer’s Installations Instructions.
3. Labeling System: Coordinate with Contracting Agency for Owner’s labeling conventions. Submit Project labeling system for approval.
4. Contractor qualifications and experience as specified in this Section.
5. Manufacturer’s Warranty as specified elsewhere in this Section, including all warranty provisions and procedures for Owner to follow to obtain warranty service.
6. Quality Assurance Plan: Contractor shall prepare a quality assurance plan which provides a detailed outline of all testing to be accomplished.
7. The Quality Assurance Plan shall include, as a minimum:
    a. A schedule of when tests will be performed relative to installation milestones.
    b. Specific test procedure that will be used.
    c. A list of test equipment that will be used including manufacturer, model number, calibration certification, range and resolution accuracy.
    d. A sample test report form with examples of data to be reported.
    e. Test plan shall be submitted to the Owner for approval at least 30 days prior to the start of testing.

B. DELETE SUPERFLUOUS INFORMATION FROM SUBMITTAL DATA, SUCH AS MODEL NUMBERS AND OPTIONS FOR EQUIPMENT CONTAINED ON MANUFACTURER'S DATA SHEETS BUT NOT USED ON THIS PROJECT.

C. One copy of approved submittals shall be kept at the job site.

1.6 SHOP DRAWINGS

A. Work shall be laid out in advance. Shop drawings shall be submitted to the Contracting Agency for approval before work begins.

B. Shop Drawings shall include dimensioned layout of Telecommunications Rooms, including backboards, patch panels, grounding terminal bus bars, ladder racking, equipment, etc. Layouts shall show lighting fixtures, HVAC equipment, etc., which affect room layouts.

C. Shop Drawings shall include dimensioned layout of major pathways for backbone and horizontal cables, including large conduits (2 inch and larger) and sleeves.

D. Work under this section has been indicated on the Drawings in locations that should allow installation without interfering with the work of other trades; however, exact finish locations cannot be indicated. Therefore, locations of all work and equipment shall be verified to avoid interferences, preserve headroom and keep openings and passageways clear. Review the plans for the work of the other trades and coordinate adjustment of this work, the work of the other trade or both to achieve the best installation for the Owner without additional claims or charges. Shop Drawings shall reflect coordination of work under this Section with the work of other trades.

1.7 REFERENCE CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only, latest edition. The reference codes and standards are minimum requirements.

Reference	Title/Revision
ANSI/ICEA	Publication S-80-576
ANSI/IEEE C2	National Electrical Safety Code
ANSI/NFPA 70	National Electrical Code
ANSI/T1E1.7/92-004R	Electrical Protection Applied to Telecommunications Network Plant at Entrances to Customer Structures or Buildings
ANSI/TIA/EIA-568-B.1	Commercial Building Telecommunication Cabling Standard Part 1: General Requirements
ANSI/TIA/EIA-568-B.2	Commercial Building Telecommunication Cabling Standard Part 2: Balanced Twisted-Pair Cabling Standards
ANSI/TIA/EIA-569-A	Commercial Building Standards for Telecommunications Pathways and Spaces
ANSI/TIA/EIA-571	Environmental Considerations for Telephone Terminals
ANSI/TIA/EIA-606-A	Administration Standard for Commercial Telecommunications Infrastructure
ANSI/TIA/EIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications
BELLCORE TR-EOP-000063	Bellcore Network Equipment Building Systems Generic Equipment Requirements
BICSI	Telecommunications Distribution Methods Manual
CFR 47 Part 68	Connection of Terminal Equipment to the Telephone Network
FCC Part 15	Radio Frequency Devices
FCC Part 68	Connection of Terminal Equipment to the Telephone Network
IEEE	LAN Standards: 802.3; 802.4; 802.5; 802.6
IEEE C62.41	Recommended Practice on Surge Voltages in Low-Voltage Surge Protective Devices
IEEE C62.42	Guide for the Application of Gas Tube Arrester Low-Voltage Surge Protective Devices

Reference	Title/Revision
IEEE Draft P1250 (D4)	Guide on Service to Equipment Sensitive to Momentary Voltage Disturbances
IEEE Std 1100	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (Emerald Book)
IEEE Std 142	Recommended Practice for Grounding of Industrial and Commercial Power Systems (Green Book)
IEEE Std 241	Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)
IEEE Std 446	Recommended Practice for Emergency and Stand-by Power Systems for Industrial and Commercial Applications (Orange Book)
NTP 638 - 3031 - 300 STD	Northern Telecom Practice "Bonding and Grounding QCF-Type Bond Clamps Description and Installation"
UL 1283	Electromagnetic Interference Filters
UL 1449	Transient Voltage Surge Protection
UL 1459	Standard for Telephone Equipment
UL 1950	Standard for Information Technology Equipment, Including Electrical Business Equipment
UL 467	Grounding and Bonding Equipment
UL 497	Protectors for Paired Conductors for Communication Circuits
UL 497A	Secondary Protectors for Communication Circuits
UL 497B	Protectors for Data Communication and Fire Alarm Circuits
UL 910	Safety Test for Flame-Propagation and Smoke Density Values for Electrical and Optical- Fiber Cables

1.8 **OPERATING CONDITIONS**

A. The electronic equipment designed for office environments and Telecommunications Rooms shall be rated for continuous operation under ambient environment conditions of 10 degrees C (50 degrees F), to 30 degrees C (85 degrees F) and 35 to 65 percent relative humidity, non-condensing.

1.9 **QUALITY ASSURANCE**

A. Perform all Work in accordance with all regulatory rules and regulations as well as references in this specification.

B. Perform all Testing in accordance with ANSI/TIA/EIA-568-B specifications and submit all printed reports.

1.10 **QUALIFICATIONS**

A. The telecommunications work specified in this Section is acknowledged to require special skills mastered by education, experience, or both. Bidders for telecommunications work described in this Section shall be specialty telecommunications contractors, who may be a division of the Divisions 26, 27 and 28 Subcontractor.

B. Contractor Certification:

1. This subcontractor shall be a certified installer of the cabling system, pre-qualified by the Manufacturer for the purpose of offering the Extended System Warranty as required in this Section.
2. Provide a signed statement indicating that the subcontractor has the ability to provide the service required by the Contract Documents using factory trained and qualified technicians for each major system type and intends to maintain that capability until the end of the guarantee period.

C. Contractor Experience:

1. Specialty subcontractors bidding telecommunications work shall have a minimum of five years experience in the construction, testing, and servicing of systems of the type and magnitude specified herein.
2. Specialty subcontractors shall have completed at least three projects equal or larger in size than this project within the past five years.
3. For each experience project submitted, provide the following information:
   a. Project name.
   b. Project location.
   c. Date of completion.
   d. Owner.
   e. Owner's representative and phone number.
   f. Description and dollar value of each installed system.
   g. Name and specific responsibility of each subcontractor or employee involved with the project.
4. For each experience project submitted, include a brief description of the system types provided and the name of the personnel directly responsible for the design (if required, and to what extent), specification, ordering, installation, programming, testing, demonstration, and overall system coordination for each of the following system types:
   a. Telecommunications General Requirements.
   b. Telecommunications Cable Pathway.
   c. Telecommunications Distribution System.
   d. Telecommunications Grounding.
   e. Telecommunications Identification and Labeling.
   f. Telecommunications Testing.

1.11 REGULATORY REQUIREMENTS

A. All Work shall conform to the requirements of NFPA 70 and all local amendments.

B. All Work shall conform to the requirements of all Federal, State and Local Electrical and Telecommunications Regulations.

1.12 SPECIAL WARRANTY

A. The warranty shall extend from the date of Substantial Completion to the longer of twenty (20) years or the length of the Extended Warranty offered by the successful manufacturer.

B. The warranty shall be extended to the Owner via the manufacturer through a single point of contact and shall be fully backed by the manufacturer.

C. The Extended Product Warranty and System Assurance Warranty for this wiring system shall be provided consisting of the following:

1. Extended Product Warranty - The Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568-B and ISO/IEC IS 11801-B, exceed the attenuation and NEXT requirements of ISO/IEC IS 11801-B for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of ISO/IEC IS 11801-B for links/channels. The warranty shall apply to all passive Telecommunication Distribution System (TDS) components.

2. System Assurance - The System Assurance shall cover the failure of the wiring system to support any existing application, as well as additional application(s) introduced in the future by recognized standards or user forums that use the ANSI/TIA/EIA 568-B or ISO/IEC IS 11801-B component and link/channel specifications for cabling.

3. All communications system components shall be rated for end-to-end system Category 5e, or greater performance levels on all pair combinations and warranted to support any existing or future applications which are designed to operate over a 100 MHz horizontal channel (as defined in ANSI/TIA/EIA 568-B.2.1), to include support of the following applications. Performance shall be guaranteed under the Special Warranty at 100 meters (328 feet):

   a. IEEE 802.3 10Base-T, 100Base-TX and 100Base-T4.

   b. IEEE 802.5 16 Mbps token ring.

   c. IEEE 802.12 Demand Priority Access Control.

   d. Asynchronous Transfer Mode (ATM) data transmission at 155 Mbps.

   e. IEEE 802.3ab 1000Base-T.

   f. Future applications that become certified under the applicable standards as noted above.

4. Extended Product Warranty - The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).

   a. In the event this specialty subcontractor is unable to perform, goes out of business or ceases to exist, the manufacturer shall be responsible for identifying a new contractor to assume the warranty work.

   b. Manufacturers shall bear full responsibility for the work of their certified installer, including all aspects of the design and installation.

   c. In the event this specialty subcontractor fails to provide satisfactory warranty support, the manufacturer shall be responsible for taking all necessary remedial steps including finding a new contractor to provide warranty work.

5. System Certification - Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

D. Submit a summary of warranty highlighting major features. Clearly disclose all exceptions to the requirements of this document, and specifically indicate any and all provisions that could potentially void the warranty or reduce its benefit to the Owner.

E. Warranty programs tentatively approved as meeting the specified warranty are listed below. Final approval is subject to review and approval of the warranty:

1. Berk-Tek/Ortronics Clarity System Warranty.
2. Avaya Systimax Program.
3. Siemon Cabling System Premium 5e Warranty.
4. Siemon System 6 Warranty.
5. Siemon/Commscope Cabling System Vision Warranty.
6. Krone TrueNet Warranty Program.
7. Ortronics Applications Assurance and Extended Warranty Program (Approved products only).
8. Berk-Tek OASIS Certified Solutions (Approved products only).

1.13 MANUFACTURERS' RECOMMENDATIONS

A. All installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed. Printed copies of these recommendations shall be submitted to the Contracting Agency 30 days prior to installation. Installation of the item shall not proceed until the recommendations are received and approved by the Contracting Agency. A copy of the recommendations shall be kept at the job site.

1.14 TERMINOLOGY

A. “TDS” shall refer to the Telecommunication Distribution System cabling and hardware infrastructure internal and external to a building or buildings used to transmit voice, video and data, etc.

B. "Stations" shall refer to individual telephone or computers, or remote peripherals of those systems (e.g., printers, facsimile machines, modems, etc.

C. "Outlets" shall refer to the group of receptacles or jacks at the location where the stations connect.

D. "Jacks" or "Ports" shall refer to the individual receptacles where phones, computers, etc. connect.

E. "Station Cables" shall refer to the horizontal cables connecting patch panels or terminal blocks in the Telecommunications Rooms to the stations.

F. “Pathways” shall refer to conduits, sleeves, cable-trays, distribution rings, etc., which are employed to route backbone and stations cables between equipment rooms, telecommunications rooms, stations, outlets, etc.

G. “Backbone Cables”, "Riser Cables" or "Tie Cables" shall refer to copper cables 25-pair or more and optical fiber cables 6-strand or more, connecting main cross-connect facilities, intermediate cross-connect facilities and telecommunications rooms. These cables may include outside plant cables between buildings and riser cables between floors.

H. “Equipment Rooms” (ER) or "Communication Equipment Rooms" (CER) shall refer to a special-purpose room that provides space and maintains a suitable operating environment for large communications and/or computer equipment. Main rooms may also be referred to as an MDF.

I. "Telecommunications Rooms (TR)" shall refer to a floor-serving facility for housing telecommunications equipment, cable terminations and cross-connect wiring. This is the point at which station cables terminate. It may also be referred to as an IDF.

J. "Terminal Blocks" shall refer to multiple punch down cable terminations.

K. “Patch Panels” shall refer to rack or frame mounted multiple punch down cable terminations with RJ-45 style, 8P8C jacks on the face for “plug and play” cross connect capability.

L. “Cable Management” shall refer to rings, troughs, gutters etc., mounted in conjunction with telecommunications distribution equipment and terminal blocks, for the orderly routing of cables, patch cords, etc.

M. “LEC” shall refer to the Local Exchange Carrier providing telephone service to the facility.

1.15 **STORAGE AND HANDLING**

A. Care shall be exercised in handling materials during construction. Damaged materials shall be repaired or replaced as directed by the Contracting Agency.

PART 2 - PRODUCTS

2.1 **GENERAL**

A. All materials shall be as specified, first quality, manufacturer’s current production.

B. The Basis of Design for copper cabling, connecting hardware, and related hardware in this section is Ortronics hardware with Berk-Tek cable Netclear Warranty Siemon hardware with CommScope cable Premium 5e, System 6 or Vision as standards for quality and performance. Listed manufacturers meeting all the system quality, performance and warranty requirements of this specification are also acceptable. The burden of proof is on the Contractor to demonstrate that all performance and warranty requirements are met. Any listed manufacturers products submitted without information giving detailed item by item comparison with the Basis of Design will be rejected without review. All manufacturers other than those listed in this section will be rejected without review.

C. The approved alternate cabling products manufacturers are: Below are the alternates. They depend on which Basis of Design you selected above. Delete the BOD from this list.

.

1. KRONE.
2. Belden.
3. Avaya.

D. The approved alternate connecting hardware products manufacturers are: Below are the alternates. They depend on which Basis of Design you selected above. Delete the BOD from this list..

1. KRONE.

2. Siemon.
3. Avaya.
4. Ortronics.

E. Products shall provide the standard of performance required under paragraph 1.1 and the Special Warranty above.

2.2 SEISMIC BRACING

A. Approved drawings of seismic assemblies shall be made available for review by the Contracting Agency or the inspecting Authority Having Jurisdiction upon request.

2.3 WALL MOUNTED EQUIPMENT RACKS

A. Where specified or shown on the Drawings, provide 19 inch wide, 14 inch deep NEMA standard open-frame, fixed, wall mounted equipment rack with the following features:

1. 25, 1 3/4 inch mounting spaces.
2. Laser cut steel, with black anodized finish.
3. Side mounted cable management brackets for vertical cables
4. Electrically isolated 3/16 inch by 3/4 inch by 18 5/16 inches ground busbar on the top rear side of the rack. Mount ground busbar on 1 inch insulating bushed standoffs.
5. Top mount cable trough
6. Equipment: Ortronics Mighty MO 4 foot Wall Mount, or as approved.

2.4 RACK MOUNTED POWER DISTRIBUTION/SURGE SUPPRESSION STRIPS

A. Where specified or shown on drawings, provide rack mounted power distribution strips/surge suppression strips for mounting in the equipment racks furnished. The power distribution/surge suppression strips shall have the following features:

1. 120 volt input and output.
2. Surge Energy Rating: minimum 480 joules.
3. EMI/RFI Noise rejection (100kHz to 10 MHz): 70.0 dB.
4. Guarded master on/off switch preventing accidental switching.
5. Designed to rack mount in a 19 inch equipment rack.
6. UL 1449 Listed.
7. UL 1449 TVSS Rating: 330V.
8. Equipment: APC Model NET9RM, or as approved.

2.5 CABLE MANAGEMENT

A. Backboard mounted cable management:

1. Distribution rings installed in communication rooms shall be “D” ring type. No bridle rings are permitted.
2. Distribution rings shall be sized according the number and size of cables to be supported plus 25% spare capacity.
3. Vertical trough-type cable management shall be minimum 6 inch wide, cable management trough, 110 Vertical Cable Management trough, or as approved.

4. Horizontal trough-type cable management shall be minimum 3-1/2 inch wide, cable management trough, 110 Horizontal Cable Management trough, or as approved.

B. Rack mounted cable management:

1. Distribution rings shall be sized according the number and size of cables to be supported plus 25 % spare capacity.

2. Distribution rings installed in communication rooms shall be “D” ring type. No bridle rings are permitted.

3. Vertical trough-type cable management for use with standard 7 foot equipment rack, shall be minimum 4 inches deep.

4. Horizontal trough-type cable management shall be 3-1/2 inch wide with horizontal and vertical routing rings, with 2 inches by 1.5 inch cutouts for through cable routing.

2.6 IDC TERMINAL MODULES

A. Connecting blocks shall match cables punched down under block, i.e., 5-pair for 5-pair color scheme, 4-pair for 4-pair cable, 3-pair for 3-pair cable, etc. When six pair are used 2-3 pair connecting blocks shall be used. For 25-pair or larger, use the 5-pair for 5-pair color scheme. All hardware shall be rated for ANSI/TIA/EIA 568-B Category 5e ratings and installed in accordance with ANSI/TIA/EIA 568-B guidelines. Blocks shall be color coded according to drawings and documented in accordance with ANSI/TIA/EIA 606-A. Blocks shall be identified using clear label holders and labels. Blocks shall be UL Listed.

B. Insulation Displacement Terminal Modules: Termination blocks shall be modular and scalable up to 500 pair termination assemblies. Provide a retaining trough between every column of termination blocks.

C. Terminal Modules shall be Type 110 mounting blocks and associated parts and shall support the system Category of the permanent channel hardware installed.

2.7 PATCH PANELS

A. Patch Panels: Modular jack panels shall be in 24 or 48 port configurations as shown on the Drawings. Modular jack panels installations shall contain a retaining trough between every panel. Modular Jack Panels shall be wired for T568B configuration.

B. The terminations shall have the following characteristics:

1. Wire Insulation Supported:

   a. Size: 0.05 inches Diameter Over Dielectric maximum for top of connecting block 0.07 inches Diameter Over Dielectric maximum for bottom of connecting block

   b. Types: All plastic insulants (including PVC, irradiated PVC, Polyethylene, Polypropylene, PTFE Polyurethane, Nylon, Teflon)

   c. Termination Type: Insulation displacement, dry, gas tight

2. Wire Size Supported:

   a. Solid Wire Ranges: 22-26 AWG, Re-termination >200

   b. Stranded (7 Strands) Wire Ranges: 22-26 AWG, Re-termination: >200

   c. Wire Insertion force (24 AWG): 13-28 lb. (59-127 Newtons)

   d. Wire pullout force (24 AWG): 2.2 lb. (9.7 Newtons)

e. Wire retention force (24 AWG): Horizontal 8 lb., Vertical 2 lb.

3. Electrical Specifications:

a. Meet or exceed performance defined by ANSI/TIA/EIA-568-B.2, for Category 5e component, link and channel performance.

b. UL Listed.

C. Designation labels for each jack shall be provided for front/rear labeling of each patch panel. All cables shall be terminated in numerical sequence and labeled as to outlet number and jack position (A, B, C, D). Provide color-coded inserts ("icons") for all jacks at patch panels and at each outlet.

D. Equipment:

1. Category 5e: Standard Density Modular Patch Panels
2. Category 5e: 110 Wiring Blocks
3. Comply with FCC Part 68.
4. ISO 9001 Certified Manufacturer.
5. Equipment: Ortronics Category 5e Modular to 110 Patch Panels

E. Category 3 Jacks double check whether or not these will be used. Avoid it.

1. All Category 3 jacks shall conform to ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL LAN Certification and Follow-up Program, and shall meet or exceed the following electrical and mechanical specifications:
2. Electrical Specifications: ANSI/TIA/EIA 568-B Category 3 minimum transmission requirements.

a. Insulation resistance: 500 MΩ minimum.

b. Dielectric withstand voltage: 1,000 VAC RMS, 60 Hz minimum, contact-to-contact and 1,500 VAC RMS, 60 Hz minimum from any contact to exposed conductive surface.

c. Contact resistance: 20 mΩ maximum.

d. Current rating: 1.5 A at 68° F(20°C) per IEC Publication 512-3, Test 5b.

3. Mechanical Performance:

a. Plug Insertion Life: 750 insertions.

b. Contact Force: 3.5 oz (99.2 g) minimum using FCC-Approved modular plug.

c. Plug Retention Force: 30 lb (133 N) minimum between modular plug and jack.

d. Temperature Range: -40 to 150°F (-40 to 66°C).

4. UL or ETL verified Category 3 Electrical Performance.
5. Comply with FCC Part 68.
6. ISO 9001 Certified Manufacturer.

2.8 INFORMATION OUTLETS/JACKS

A. Faceplate Requirements:

1. Configure single gang outlet information outlets in single, duplex, triplex, quad-plex, or six-plex jack arrangement, as indicated on the Drawings.
2. Provide outlet faceplates with both top and bottom labeling positions.
3. Provided blank module inserts for all unused module locations.
4. Equipment: Refer to Specification Section 26 2726-Wiring Devices for faceplate type/color.

B. Jack Requirements:

1. Jacks for Voice and Data:
   a. Communications jacks shall consist of multi-position 8-pin modular (8P8C) jacks, utilizing T568B termination style.
2. Category 5e Jacks:
   a. Jacks shall be manufactured by the same manufacturer as the modular patch panels.
   b. All Jacks shall conform to ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section and shall meet or exceed the following electrical and mechanical specifications:
      1). Electrical Specifications: Jacks shall meet or exceed performance specifications for the Channel as defined by ANSI/TIA/EIA-568-B.
      2). Mechanical Specifications:
         a) Plug Insertion Life: 750 insertions.
         b) Contact Force: 3.5 oz (99.2 g) minimum using FCC-Approved modular plug.
         c) Plug Retention Force: 30 lb (133 N) minimum between modular plug and jack.
      3). Temperature Range: -40° to 150°F (-40° to 66°C).
      4). Comply with FCC Part 68.
      5). ISO 9001 Certified Manufacturer.
      6). Equipment: Ortronics TracJack outlet.

2.9 WALL MOUNTED TELEPHONE LOCATIONS

A. At wall mounted telephone locations, provide telecom outlet with VoIP telephone hanger bracket that accommodates a telecommunications modular jack as specified in this section. Provide one horizontal cable from jack to telecom room.

2.10 PATCH CORDS

A. Provide factory assembled Category 5e Modular Patch Cords for each assigned port on the patch panel. All cords shall conform to the requirements of ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cabling Section, and be part of the UL LAN Certification and Follow-up Program. Cords shall be equipped with an 8 pin modular connector on each end and the minimum length patch cord shall be provided in each instance, to make an orderly, manageable connection between the patch panels or equipment being cross-connected.

B. Unless shown otherwise on the Drawings at each location, provide spare Patch Cords of each length and type in each telecommunications room, with blue identified for data and natural for voice patching.

4 foot:	6	each blue and	6	each natural
7 foot:	6	each blue and	6	each natural
10 foot:	2	each blue and	2	each natural
15 foot:	2	each blue and	2	each natural

C. All patch cords shall be round, and consist of 24-AWG copper, stranded conductors, tightly twisted into individual pairs.

D. Patch cords shall be manufactured by the manufacturer of the patch panels and jacks and meet or exceed the Channel performance defined by ANSI/TIA/EIA-568-B.

E. UL or ETL Verified for ANSI/TIA/EIA 568-B Electrical Performance.

F. The patch cord shall have exclusion features to prevent accidental polarity reversals and split pairs.

G. UL Listed for Fire Safety.

H. ISO 9001 Certified Manufacturer.

I. FCC Compliant.

J. Provide Patch Cord storage boxes for all spare patch cords provided in each TR.

2.11 HORIZONTAL CABLES

A. General:

1. Data cables shall be extended between the station location and its associated TR and shall consist of 4 pair, 24 gauge, UTP, and shall be terminated on the 8 pin modular jacks provided at each outlet. Cable jacket shall comply with Article 800 NEC for use as a plenum The 4 pair UTP cable shall be UL Listed Type CMP (plenum).
2. Where conduit is run below slab-on-grade, the cable jacket shall be wet location rated.
3. Provide cables with four FEP insulated conductor pairs (4/0 configuration)
4. Category 5e UTP, 4 Pair

5. All cables shall conform to the ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL LAN Certification and Follow-up Program.
6. Electrical Specifications:
    a. DC resistance: 28.6 Ω/1,000 ft (9.38 Ω/100 m),maximum.
    b. DC resistance unbalance: 5%, maximum.
    c. Mutual capacitance @ 1 MHz: maximum pF/ft: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.
    d. Delay skew: ns/100m [328 ft.]: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.
    e. Worst pair attenuation, dB/100m [328 ft.]: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.
    f. NEXT, dB at 100m [328 ft.]: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.2.
    g. PSNEXT, dB at 100m [328 ft]: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.2.
    h. ELFEXT, dB at 100m [328 ft.]: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.2.
    i. PSELFEXT, dB at 100m [328 ft]: meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.2.
    j. Worst Pair Structural Return Loss (SRL), dB at 100m (328 ft.): meet or exceed the performance values specified in ANSI/TIA/EIA-568-B.2.
7. Cables shall meet or exceed Category 5e performance specifications for the Channel as defined by ANSI/TIA/EIA-568-B.2.
8. Environmental:
    a. Storage temperature: 68° F to 122° F (20° C to 50° C).
    b. Installation Temperature: 32° F to 122° F (0° C to 50° C).
    c. Operating Temperature: 14° F to 140° F (-10° C to 60°.
9. UL or ETL Verified for Category 5e Electrical Performance.
10. UL Listed for Fire Safety.
11. ISO 9001 Certified Manufacturer.
12. Equipment: Commscope or as approved.

2.12 OUTSIDE PLANT CABLES

A. All voice grade wire and cable placed in the outside environment shall be solid, twisted pair, and multi-conductor. The copper twisted pairs shall have a mutual capacitance at 1 MHz of 15.7 nF/1,000 ft. The cable shall be resistant to mechanical damage, lightning or damage from wildlife.

B. The buried or underground cable shall have an aluminum steel polyethylene (ASP) sheath and a core of solid-copper conductors, dual insulated with foam skin and plastic, surrounded by water blocking compound.

C. The multi-pair copper cables shall meet the following specifications:

1. Physical Specifications:
   a. Gauge: 24 AWG.
   b. Pair Size: 25 to 1,800.
2. Electrical Specifications:
   a. DC Resistance: 27.3Ω/1000 ft (8.96Ω/100m), maximum.
   b. Mutual Capacitance (@ 1 MHz): 15.7 nF/1000 ft (5.15 nF/100m) (25 pair), maximum.
   c. Impedance: 100 Ω (25 pair).
3. Buried/Underground Cable Attenuation (db/1,000 ft [305m]):
   a. at 772 kHz: 5.6 (25 pair), maximum.
   b. at 1.0 Mhz: 6.4 (25 pair), maximum.
4. ISO 9001 Certified Manufacturer:

2.13 SPLICE CLOSURES

A. Closures shall be 3M 1500 Pair Part #KB7-100-15 or approved equal.

B. Modular splices shall be 3M MS2 or Avaya (Lucent Technologies) 710 or approved equal.

2.14 LABELING

A. Provide machine printed labels for all patch panels, cables, outlets, etc., in accordance with ANSI/TIA/EIA-606-A. Provide labeling nomenclature in accordance with information on the Drawings or Owner's labeling conventions. Submit labeling samples for all required applications.

B. Machine Printed Label Requirements:

1. PC Compatible.
2. Can save and modify files.
3. Fully integrated with AutoCAD.
4. Editable Fonts and Sizes.
5. Rotate Text and Objects.
6. Vary Line Spacing.
7. Ability to import graphical images.
8. Capable for customization of layout.
9. Re-positional labels.

C. Labeling and color coding identification for this project shall conform to TIA/EIA-606-A for a Class 2 Administrative System.

2.15 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the Drawings or in this document and required to provide a complete and functional TDS installation shall be provided in a level of quality consistent with other specified items.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide, connect and test all equipment and materials for the systems herein specified and shown on the Drawings. All wiring shall be neatly tied or laced in cabinets and terminated on terminal strips provided for the purpose. Each cable shall be identified by an approved marking system at each end.

B. Outlet/Jacks shall be identified with machine printed labels. Hand lettered labels shall not be used.

C. Provide labels and color-coded inserts for each jack at patch panels, in accordance with TIA/EIA-606-A.

D. Provide full set of snap-in icons for workstation outlets for use by Owner to mark jacks for analog and digital telephones as two unique classes of data. Store icons in clear plastic bags in each IDF/MDF.

E. Wherever materials, methods or placements of materials and equipment for the communications work is provided by other Subcontractors or the Owner, it shall be the responsibility of this specialty Subcontractor to coordinate that work and assure that it is provided in such a manner as to enhance the final system operation.

F. Coordinate installation of lighting, ventilation and all other systems in the communication rooms to avoid interferences.

G. Test the systems, demonstrate operation to the Contracting Agency and provide training as specified.

H. In each TR, IC, MDF, IDF and equipment room provide a minimum of a 30 inches by 42 inches CAD drawing indicating floor plan and telecommunication one-line. The floor plan shall indicate telecommunication outlets with the appropriate outlet designation indicated on the plan. Mount drawing beneath a sheet of 1/8 inch clear Plexiglas on wall. Provide marking pens attached with Velcro to facilitate marking when moves, adds, or changes occur. Plexiglass and floor plan shall be mounted in such a way as to allow easy and rapid updates to the underlying floor plan. Include all copper and optical fiber systems on this drawing.

I. Work under this section shall be closely coordinated with work under other sections of the project.

3.2 CODES AND PERMITS

A. Apply and pay for all fees, permits, and obtain serving utility and governmental approvals.

B. Coordinate all work with the serving utility.

C. Raceway fill requirements for communications systems shall be in accordance with ANSI/TIA/EIA-569-A and BICSI.

D. NEC bending radius of all communications ducts, raceways, cabletrays, etc., shall be increased to not less than the installed cable manufacturer's recommendations, and the applicable ANSI and BICSI Standards.

E. Communications work shall be in complete accordance with the following:

1. National Electrical Code (NEC), latest legally enacted edition.
2. Regulations of the State Fire Marshal.
3. National Fire Protection Association (NFPA) Codes.
4. All state, county and local codes and ordinances.

3.3 DELIVERY AND STORAGE

A. Materials and Equipment shall be stored with protection from mechanical damage, weather, humidity and temperature variation, dirt and dust, and other contaminants.

B. Materials shall be inspected and inventoried promptly upon receipt.

C. Cables shall be tested immediately upon receipt and received or rejected and returned based upon testing or visual inspection.

D. Report and record all serial numbers received and/or rejected.

E. All inspection and testing shall be performed under the observation of the Contracting Agency at the Contracting Agency's option. Provide three (3) working days advance notice of tests.

3.4 LAYOUT

A. All work shall be laid out in advance. Shop drawings shall be submitted to the Contracting Agency for approval before work begins. Maximum height for terminal blocks and patch panels shall be 6 feet-6 inches, minimum height shall be 1 feet-6 inches. Cables shall be racked and supported in a workmanlike fashion. All work shall be labeled according to ANSI/TIA/EIA 606-A, and color coded according to BICSI Standards. In the absence of details on the drawing governing the layout of terminations, the following guidelines shall apply.

1. All horizontal cables from a common outlet shall terminate sequentially (in groups) on the same patch panel unless the cables are of different performance levels such as Category 5e and 6.
2. Horizontal cables that are of different performance levels, such as Category 5e and 6, shall be terminated on different patch panels, and identified accordingly.
3. Pairs from each cable shall be terminated sequentially from left to right, top to bottom starting with the lowest assigned number at the upper left hand corner of the frame.
4. Trunk or riser cables shall terminate on dedicated terminal blocks, separate from but adjacent to horizontal terminal blocks. Cross-connect or patch cords longer than 18 feet shall be avoided. Install stress relief hardware where needed.

B. Keep up to date "As-built" record drawings at each job site detailing the layout of all data racks and telephone, data and trunk terminations, including a typed listing of cables/rooms served by each terminal block and patch panel. Refer to Section 26 0000 - Electrical General Requirements for other Record Document requirements.

C. Layout Shop Drawings shall be prepared using CAD. Final approved Shop Drawings shall be updated with precise "as-built" conditions and shall be submitted with the Operations and Maintenance Manuals. File format shall be AutoCAD "DWG" or "DXF."

3.5 CABLE INSTALLATION

A. If cable dimensions shown are exceeded, all cable pathways and supports shall be resized to maintain the original fill ratios based on the dimensions shown.

B. Follow cable manufacturer's specification regarding handling methods, retaining/support methods, bending radius and maximum pulling tension limitations.

C. Telecommunication cables shall not be installed in the same raceway as power cables.

D. Cables shall be installed in a neat and orderly manner and shall not cross or interlace other cables except at breakout points.

E. Cables in vertical trays shall be individually retained with straps at a maximum of 6 feet on center.

F. Tie wraps shall not deform the cable insulation when tightened.

G. All cables shall be routed to minimize EMI and RFI interference. All cable shall be routed according to the following table. Spacings are minimum for all Category 3 and higher cable.

Minimum Separation of Telecommunications pathways from 480 volt or less power lines

Condition	<2 kVA	2-5 kVA	>5 kVA
Unshielded power lines or electrical equipment in proximity to telecommunications open or nonmetal pathways.	5 in	12 in	24 in
Unshielded power lines or electrical equipment in proximity to telecommunications grounded metal conduit pathways	2.5 in	6 in	12 in
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a telecommunications grounded metal conduit pathway	N/A	3 in	6 in
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to telecommunications open or nonmetal pathways.	2.5 in	6 in	12 in
Mechanical ductwork, metal floors and other metallic planes to telecommunications open or nonmetal pathways.	2 in		
Mechanical ductwork, metal floors and other metallic planes to telecommunications open or grounded metal conduit pathways.	0 in		
Fluorescent or HID lighting fixtures	5 in	5 in	5 in

3.6 **LUBRICANT**

A. Pulling lubricant, shall be used to minimize pulling tension and prevent sheath damage when pulling cables into ducts and conduits. Lubricant shall be applied to the cable sheath with a lubricator. When pulling has been completed, the exposed cable ends shall be wiped clean of lubricant.

B. Lubricants shall be compatible with and intended for use with plastic-sheathed cables. Soap and grease type lubricants shall not be allowed.

C. All equipment and the pulling set shall be checked to minimize interruptions once pulling begins. Cable shall be pulled without stopping until the required amount of the cable has been placed. When the pulling operation is halted before the pull is completed, the tension of the pulling line shall not be released. When pulling is resumed, the inertia of the cable shall be overcome by increasing the tension in small steps a few seconds apart until the cable is in motion. Cable shall be paid from the top of the reel by rotating the reel in the feed direction at the rate of pull. Cable shall not be stripped off the reel by pulling.

3.7 **SEAL**

A. Ducts in which cable is placed shall be sealed with urethane foam duct seal. This material shall be inserted between the cable and the duct and in all unused ducts, in order to prevent damage to the cable sheath and to prevent the entrance of dirt or water into the manhole or vault.

3.8 **DAMAGE AND DEFECTS**

A. Use a tension monitoring device to ensure that the maximum pulling tension that may be applied to the cable to be pulled into a conduit section is not exceeded. Provide replacement cable if cable manufacturer's maximum pulling tension is exceeded at any time during a pull.

B. Cable shall be carefully inspected for sheath defects or other irregularities as it is paid out form the reel. When defects are detected, pulling shall stop immediately and the cable section shall be repaired or replaced at the discretion of the Contracting Agency. A system of communications shall be maintained between pulling and feed locations so that pulling can be stopped instantly, when required.

C. Cable shall be hand guided through intermediate manholes and into the next duct section when making pull-throughs. Proper rigging shall be used in the intermediate manhole to keep the pulling line and cable aligned with the exit duct to prevent the line or cable from rubbing against the edge of the duct. Cables in pull-through manholes shall be set up and racked before the cable ends in adjacent manholes are set up and racked.

D. Cable ends pulled into manholes, vaults, or terminal locations that are not to be racked or otherwise permanently positioned immediately shall be tied in fixed positions to prevent damage to the cables and provide adequate working space.

E. Adequate care shall be exercised when handling and storing reels of cable to prevent damage to the cable. Cable with dents, flat spots, or other sheath distortions shall not be installed.

3.9 DISTRIBUTION RINGS AND CABLE SUPPORTS

A. Layout distribution rings in accordance with the contract drawings and cable spacing requirements. Set rings so that taps or changes in direction do not exceed 45 degrees.

B. Mount J-hooks on appropriate mounting hardware suitable for the specific application. Mount securely to the building structure. Maximum support spacing shall be 4 feet on center.

C. Coordinate the layout of cableways with all other trades. Report conflicts to Contracting Agency for resolution by the Contracting Agency.

3.10 TERMINATION MODULES

A. Layout telephone and data terminal blocks as indicated on drawings with spacing as recommended by manufacturer.

B. Ground all metal back frames with #6 insulated copper to the Chassis Ground System (CGS). Use Cool Amp bolted connections or Cadweld connections.

3.11 CROSS-CONNECTIONS

A. Cross-Connections at and/or between all terminal hardware shall be provided to form a complete and functioning system.

B. Patch Cords shall be used to make all Cross-Connections.

C. Cross-Connections from Terminal Modules color coded White to Terminal Modules color coded Blue shall be 4-pair wide and serve a single jack or termination in the horizontal distribution.

3.12 INTERCONNECTIONS

A. Interconnections at all terminal hardware shall be provided to form a complete and functioning system.

B. Equipment cables shall be interconnected to horizontal cabling on Termination Modules color coded blue.

3.13 EQUIPMENT RACKS

A. Equipment racks shall be seismically braced by securely bolting to the structural floor supplemented with additional braces as required for the Seismic Zone.

1. Mount ground bars on insulating bushed standoffs.
2. Connect Wiremold to power outlets.
3. Electrically separate open racks with insulating washers and nonconductive screws.
4. Electrically separate enclosed racks with insulating washers and nonconductive screws.

3.14 TERMINATIONS

A. Cables shall be marked with wire markers at both ends, and terminals on terminal blocks or patch panels shall bear the cable number. Trunk cables shall be neatly marked with "From-To" information.

B. Wire twist shall be maintained to within 0.25 inch of the termination.

3.15 TERMINATION MODULES

A. Install per manufacturer's recommendations.

B. Protection modules shall conform to NEC 800-30 and be installed per manufacturer's recommendations.

3.16 COMPLETION AND TESTING

A. Telecommunications System test reports shall be submitted to and approved by the Contracting Agency. The test reports shall certify that the Telecommunications Distribution System is complete, passes all test criteria, is fully operational, and that all work has been witnessed as specified.

B. After installation and test of each system is complete, each system and the entire system shall be demonstrated and tested for proper operation. The Contractor shall schedule a demonstration with the following representatives present:

1. Contractor's representative.
2. Manufacturer's representative for each major communications subsystem.
3. Contracting Agency's representative.

C. The Contractor shall provide all forms, instrumentation and test equipment, loads, and other consumables required to demonstrate the systems to the Contracting Agency's satisfaction.

D. Incoming Inspection Tests:

1. Inspect all materials for damage.

E. Patch Cord Testing:

1. All patch cords shall be tested and shown to comply with the applicable Category cord requirements of TIA/EIA-568B.
2. Compliance shall be proven by testing patch cords alone (i.e., not by inserting the patch cords into a channel).
3. Cord performance shall be measured on-site by either using either the TIA method delineated in Annex J or by using a cord-test adapter and a hand-held LAN cable tester. Cord compliance may be demonstrated by actual test reports supplied by the patch cord manufacturer.

F. Final Inspection Tests:

1. Testing of all copper wiring shall be performed prior to system acceptance. 100 percent of the horizontal and riser wiring pairs shall be tested. Link testing of all copper cabling shall be performed. Complete, end to end test results shall be submitted to the Contracting Agency.
    a. Category5e cable runs shall be tested for conformance to the specifications of EIA/TIA 568-B.2, Category 5e.Testing shall be done with a ANSI/TIA/EIA 568-B ETL verified Level II-E test set, with accuracy per Proposed TIA Level III standards.
        1). Test shall include all requirements of ANSI/TIA/EIA 568-B, including wiremap, length, characteristic impedance, insertion loss, ambient and impulse noise, NEXT, PSNEXT, FEXT, ELFEXT, PSELFEXT, return loss, ACR, PSACR, Propagation Delay and Delay Skew.

2). Supported test frequency shall be 1-350 MHz to provide re-certification capability beyond Category 6 requirements.

3). "Full Plot" storage shall store entire test, and be capable of uploading saved data and re-characterizing cables against new or evolving performance standards. Testers only saving worst case data are not acceptable. Test data shall be saved and provided to the Owner in neatly bound hardcopy and electronic format compatible with ScopeData Pro® software. Provide a copy of the software with the data.

4). Reports shall be graphic, showing test results plotted against standards. Reports shall include a pass/fail summary of all network types specified.

5). Any cables not meeting the requirements of the standard shall be brought into compliance at no charge to the Owner.

6). Tester shall be equal to Agilent Technologies (HP) WireScope 350, Fluke DSP-4000, or IDEAL LANTEK 6P. Test all cable with an approved cable tester in the presence of the Contracting Agency, at the Contracting Agency's option. Provide three (3) working days advance notice of tests. Record cable numbers on data test reports. Submit reports to Contracting Agency.

3. Test all cables from both ends.

4. Re-test all cable disturbed after testing, at the direction of Contracting Agency.

5. Spare unterminated cable shall be temporarily terminated for testing.

G. Replace all rejected materials.

H. Test AC grounds and voltages in equipment racks.

1. Record voltage at equipment rack power source both at no load and at 15 Amp resistive load.

3.17 OPERATING AND MAINTENANCE MANUALS

A. Prepare manuals describing the servicing and maintenance requirements for the equipment being provided as required in this Section of these specifications.

B. Information contained in the manuals shall consist of catalog data on each item, together with parts lists, wiring diagrams, test reports, description of routine maintenance required, suggested frequency of maintenance and recommended practices, and shall be 8-1/2 inches by 11 inches in size. Catalog pages and data in manuals shall be neat, clean copies. Drawings shall be accordion folded to above size. An index shall be provided which shall list all contents in an orderly manner. Include corrected shop drawings in the maintenance manuals. Each copy of the instruction manual shall be adequately labeled for identification and shall include plastic tabs coordinated with the index.

C. Provide "Step-by-step" instructions for interpreting and utilizing the cable, outlet, jack and equipment identification system, including instruction for use of jack icons.

D. Refer to "Submittals" requirements of this Section for additional O&M requirements.

3.18 INSTRUCTION AND TRAINING

A. Provide factory trained and authorized instruction in the proper operation and maintenance of all equipment shown on the Drawings and specified herein.

B. Provide detailed instructions to the Owner on how to obtain warranty service under the Special Warranty.

END OF SECTION 27 2010

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 3100
ADDRESSABLE FIRE ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification provides the requirements for the installation, programming and configuration of a complete Addressable Intelligent Life Safety System Network for this project. The system shall include, but not limited to: Fire Alarm Control Panel(s), , Automatic and Manually activated alarm Initiating and Indicating Peripheral Devices and Appliances, conduit, wire and accessories required to furnish a complete and operational Life Safety System.

1.2 SCOPE

A. Provide in operating condition an electrically operated, electrically supervised digital multiplexed fire alarm system as described herein. The system shall include, but not be limited to, control unit, power supplies, alarm initiating and indicating devices, conduit, conductors, fittings and accessories required to provide a complete operating system. Units shall be located in accordance with plans.

B. Provide all related demolition in support of the project. Refer to the Plans and Section 26 0000-3.01- Electrical General Requirements for additional requirements and information. Existing fire alarm system shall remain operational until the new system is final accepted by the local authorities having jurisdiction and the Contracting Agency, with exceptions only as allowed in Section 26 0000 - Electrical General Requirements.

1.3 REFERENCES

A. The equipment and installation shall comply with the current provisions of the following Codes and Standards:

1. National Electric Code, Article 760.
2. National Fire Protection Association Standards:
   NFPA 72 National Fire Alarm Code
   NFPA 101 Life Safety Code
3. Local and State Building Codes.
4. Local Authorities Having Jurisdiction.
5. Underwriters Laboratories Inc.

B. The system and components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:

UL 864/UOJZ, APOU	Control Units for Fire Protective Signaling Systems.
UL 268	Smoke Detectors for Fire Protective Signaling Systems.
UL 268A	Smoke Detectors for Duct Applications.
UL 217	Smoke Detectors Single Station.
UL 521	Heat Detectors for Fire Protective Signaling Systems.
UL 228	Door Holders for Fire Protective Signaling Systems.
UL 464	Audible Signaling Appliances.

UL 1638	Visual Signaling Appliances.
UL 38	Manually Activated Signaling Boxes.
UL 346	Waterflow Indicators for Fire Protective Signaling Systems.
UL 1971	Standard for Signaling Devices for the Hearing Impaired.
UL 1481	Power Supplies for Fire Protective Signaling Systems.
UL 1711	Amplifiers for Fire Protective Signaling Systems.
UUKL	Smoke Control Equipment

C. Americans with Disabilities Act (ADA).

D. International Standards Organization (ISO).

1. ISO-9000.
2. ISO-9001.

1.4 SYSTEM DESCRIPTION

A. The Fire Alarm / Life Safety System supplied under this specification shall be a microprocessor based network system. Control Panel Assemblies and connected Field Appliances shall be provided by the same company, and shall be tested and cross listed as compatible to ensure that a fully functioning Life Safety System is provided.

1.5 QUALITY ASSURANCE

A. Qualifications of Contractor

1. The contractor shall have successfully installed similar system fire detection, evacuation and visual signaling control components on a previous project of comparable size and complexity. The Contracting Agency reserves the right to reject any control components for which evidence of a successful prior installation performed by the Contractor cannot be provided.
2. The Contractor shall have in house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall:
   a. Perform the detailed engineering design of central and remote control equipment.
   b. Produce panel and equipment drawings and submittals, and operating manuals.
   c. Coordinate system installation requirements, and final system testing and commissioning in accordance with these specifications.
3. The installation of the system shall conform to the State of Alaska regulations.
4. The Manufacturer shall be a nationally recognized company specializing in fire alarm systems and shall employ factory trained, NICET certified technicians. The Manufacturer shall maintain a service organization in Alaska and have a minimum of 5 years of experience in the fire alarm industry.
5. The installer shall be a company specializing in the installation of fire alarm systems and be factory certified by the Manufacturer for their system. The installer shall have a minimum of 3 years of experience installing fire alarm systems. The installation shall be fully field verified by a factory trained and authorized technician and hold a NICET Level III certification.

1.6 **SUBMITTALS**

A. Provide submittals for products in accordance with Section 26 0000 - Electrical General Requirements and Division 1.

B. Submit for approval manufacturer's catalog information with complete description of panel mounted and remote equipment.

C. Include complete one-line risers and point-to-point wiring diagrams prepared especially for this installation.

D. The supplier of the system shall provide conduit layout drawings of the system, indicating type, size and number of all conductors, conduits and junction boxes.

E. Provide calculations verifying standby battery capacity per NFPA 72, including manufacturer's published current consumption data for equipment on the System.

F. Provide calculations verifying that notification appliance circuits voltage drops do not exceed the limits further specified in this Section.

G. DELETE SUPERFLUOUS INFORMATION FROM SUBMITTAL DATA, SUCH AS MODEL NUMBERS AND OPTIONS FOR EQUIPMENT CONTAINED ON MANUFACTURER'S DATA SHEETS BUT NOT USED ON THIS PROJECT.

H. Submit to the Authority Having Jurisdiction and obtain a written statement of Approval of the proposed system. This Approval shall be obtained prior to submitting to the Contracting Agency.

1.7 **OWNER'S MANUALS**

A. Furnish complete sets of Operation and Maintenance Manuals and other information necessary for the operation and maintenance of the system in accordance with Division 1 requirements. Provide number of sets as required in Division 1, however if not specified, provide a minimum of two (2) complete sets.

1.8 **WARRANTY AND SERVICE**

A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of 12 months from date of final completion. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully-staffed branch office located within a reasonable distance from the job site.

B. Service availability: The supplier shall have sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 24 hours of service calls 7 days a week to service completed systems.

C. The Engineered Systems Distributor of the Fire Alarm / Life Safety Equipment specified herein shall provide a copy of their certificate of successful completion of an authorized Training Course given by the Manufacturer of the Fire Alarm / Life Safety Equipment.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. These specifications are based on equipment from Edwards System Technology (EST3) to set a standard for design and quality. Equipment manufactured by others is an acceptable alternate provided that sufficient documentation is submitted to the Contracting Agency that certifies that their equipment meets the requirements of these specifications.

2.2 GENERAL

A. Equipment furnished for this project shall be new and unused. Components and systems shall be designed for uninterrupted duty. Equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be suited for the intended use and shall be provided by a single manufacturer. If the equipment provided under this Specification is provided by different manufacturers, then that equipment shall be recognized as compatible by both manufacturers, and “Listed” as such by Underwriters’ Laboratories.

B. System installation and operations shall be verified by the manufacturer’s representative and a verification certificate presented upon completion. The manufacturer’s representative shall be responsible for an on-site demonstration of the operation of the system and initial staff training as required by the Contracting Agency.

C. The system shall be capable of detecting the electrical location of each Signature intelligent device including new and existing devices. It shall be possible to display the intelligent device map on the laptop PC.

D. It shall be possible for authorized service personnel using a Program/Service Tool or laptop PC to change the personality/function of a Signature Series Device to meet changes in building layout or environment. System changes shall be verified by the manufacturer’s representative and a verification certificate presented upon completion.

2.3 AUTOMATIC ALARM OPERATIONS

A. Operation of each alarm input device shall show on the LCD display at Control Panel Each Intelligent device shall annunciate individually.

B. LCD display messages shall be approved by the Authority Having Jurisdiction and the Owner prior to equipment ordering and programming. Changes required by the AHJ or the Owner shall be implemented without increase in the Contract Amount.

C. The system shall be capable of displaying events by type (fire alarm, pre-alert, supervisory, and trouble). At the same time, the system shall sound a momentary audible signal for each event occurrence; flash an LED when an unacknowledged event exists, and, update the display to annunciate the total by type.

D. Upon alarm, the system shall sound the evacuation signals throughout the building.

E. The system shall display operational status of each signal circuit to inform the emergency user of the system status.

F. Upon alarm, the system shall shut down air supply fans. Shutdowns shall be hardwired from the Fire Alarm System (i.e., not implemented via building automation controls) and immediate acting, and shall not be overridden by Hand-Off-Auto switches or other controls.

G. Upon alarm, the system shall de-energize door holders to release fire doors. Provide separate circuit(s) as necessary for operation of all door holders. If door holders are 120VAC, circuits shall be from the same panelboard used to supply the fire alarm control panel. If door holders are 24V, circuits shall be from the fire alarm control panel using 120VAC to 24VAC transformers. Door holder circuits shall be fused as necessary to prevent damage to the Fire Alarm System. Submit for approval all proposed power sources prior to installation or connection of equipment.

H. Upon alarm initiated by the sprinkler flow switch(es), the system shall sound the exterior sprinkler bell and sound the evacuation signals throughout the building. The sprinkler bell shall be supplied by a non-silenceable supervised notification circuit.

I. Upon alarm, the system shall de-energize smoke dampers and smoke/fire dampers to close dampers. Provide a commandable relay for control of each damper. Provide addressable input modules to monitor the damper end switches for damper position and indicate the damper position at the Fire Fighter's control.

J. Upon alarm, the system shall effect the locking/unlocking of emergency exits connected to the building fire alarm system.

K. Separate Alarm and trouble conditions shall be transmitted to the Building Automation System (BAS) and Building Security System. Common alarm, common trouble and common sprinkler alarm conditions shall be monitored by the BCS and Security Systems. Provide separate sets of outputs for the BCS and Security Panels.

2.4 EQUIPMENT

A. The Life Safety System shall be a Multi-Processor Based Network System designed specifically for Fire applications. The Life Safety System shall be UL listed under Standards 864 (Control Units for Fire-Protective Signaling Systems) under categories UOJZ and APOU, and ULC listed under standard CAN/ULC-S527.

B. The Life Safety System shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions and operations:

1. Modular systems design, with a layered application design concept, including an "Operational Layer" and a "Human Interface Layer," to allow maximum flexibility of the system with a minimum physical size requirement.
2. System operational software shall be stored in FLASH memory. Control Panel disassembly, and replacement of electronic components shall not be required in order to upgrade the operations of the installed system to conform to future application code and operating system changes.
3. Up to 128 Service Groups shall be definable within the system program to allow the testing of the installed system based on the physical layout of the system, not on the wiring of the field circuits connected to the Fire Alarm Control Panel.
4. Advanced Windows™-based System Definition Utility with Program Version Reporting to document changes made during system start-up or system commissioning. Time and Date Stamps of modifications made to the program shall be included to allow full retention of all previous program version data.
5. System response to any alarm condition shall occur within 3 seconds, regardless of the size and the complexity of the installed system.

6. System Common Control Functions shall be automatically routed to any node of the system as a function of the time of day and date.

2.5 THE LIFE SAFETY SYSTEM

A. The Life Safety System shall include the following features and shall support the following operations in each installed cabinet or node of the system:

1. Up to 10 Signature Series Intelligent Device loops.
2. Up to 125 Intelligent Smoke Detectors and 125 Intelligent Modules per Signature Device Card (SDC).
3. Up to 120 Hardwired input/output Circuits.
4. Up to 342 Manual Control (Input) Switches.
5. Up to 456 LED Annunciation Points.
6. Up to 63 Remote Display Units.
7. Multi-Priority, token passing, peer-to-peer network connection of up to 64 system nodes wired as Class A (Style 7).
8. Ground fault detection by panel, by Signature Data Circuit, and by device module.
9. Ability to download all system applications programs and “firmware” from a computer through a single point in the system.
10. True Distributed Intelligence, including microprocessor-based Detectors and Modules.
11. A.C. Power Trouble Delay adjustable from 4 Hours to 10 Hours.
12. Removable, Interlocked terminal blocks for the connection of the field wiring to the Fire Alarm Control Panel.
13. Electronic Addressing of Field Devices.
14. Advanced Power Management.
15. Dead Front Construction.

B. System Common Controls and Emergency User Interface: The Fire Alarm / Life Safety System shall include a Emergency Operators’ Interface Panel which shall include the following system annunciation and control functions:

1. System Annunciation and Control Functions:
    a. Hands free Emergency Operation. The first and last highest priority event on the system shall be displayed automatically and simultaneously.
    b. Control Panel Internal Audible Signal shall have four programmable signal patterns, to allow for the easy differentiation between Alarm, Supervisory, Trouble and Monitor conditions within the installed system.
2. Discrete “System Status” LEDs:
    a. Power Status LED - Green LED shall illuminate when AC power is present.
    b. Test Status LED - Yellow LED shall illuminate when any portion of the system is in the test mode. A programmable timer shall cause the system to automatically exit the test mode after a period of system inactivity. This Test LED shall function in a local or in a group mode.

c. CPU Fail Status LED - Yellow LED shall illuminate when the panel controller has an internal failure.

d. Ground Fault Status LED - Yellow LED shall illuminate when ungrounded wiring connected to the cabinets' power supply has continuity to ground. This feature shall function in either a local or group mode.

e. Disable Status LED - Yellow LED shall illuminate whenever any point or zone in the installed system is manually disabled.

3. Discrete Common Control Switches with associated Status LEDs:

a. Reset: Depression of the Reset Switch shall start the system reset operation. The associated Yellow LED shall have three flash rates during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power down sequence, then it shall flash slowly during the restart phase, and shall illuminate steadily for the restoral phase. The LED shall go out completely when the system is back to normal mode. Each phase, as well the overall reset cycle shall be programmable to perform other functions.

b. Alarm Silence: Depression of the Alarm Silence Switch shall turn off all (audible and/or visible) Notification Appliance Circuits. The associated yellow LED illuminates when the Alarm Silence function is active, whether by the Alarm Silence Switch, or by an integral software timer. Subsequent activation of the Alarm Silence Switch shall resound the signals. Activation of the Alarm Silence switch shall be programmable to perform other functions.

c. Panel Silence: Depression of the Panel Silence Switch shall turn off the systems' internal audible signal when configured as a 'local' system. The associated yellow LED illuminates when the panel silence feature is activated.

4. Other Operator Control Switches:

a. Previous Message Switch: Pressing the Previous Message Switch shall scroll the display to show the preceding message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the top of the respective queue event list. Scrolling through event messages may be done by the operator at any time.

b. Next Message Switch: Pressing the Next Message Switch shall scroll the display to show the following message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the bottom of the respective queue event list. Scrolling through event messages may be done by the operator at any time.

c. More Details Switch: Pressing the More Details Switch shall show the address and 42 character location message of the active device on display. If a zone is active, pressing the switch displays the address and message of active devices within the zone. When multiple devices are active, the "Previous/Next" message switch may be used to scroll through the messages.

5. The System Main Liquid Crystal Display: The Liquid Crystal display shall provide the means to inform the System Operator with detailed information about the off-normal status of the installed Fire Alarm / Life Safety System. The Main Display shall automatically respond to the status of the system, and shall display that status on a 8 line by 21character backlit alpha-numeric Graphical Liquid Crystal Display. The following status functions shall be annunciated by the Main Liquid Crystal Display:

a. When the Fire Alarm / Life Safety System is in the “Normal” Mode, the LCD displays: The current Date and Time. A Custom System Title. A summary total of the Alarm History of the system.

b. With the Fire Alarm Life Safety System in the Alarm Mode, the LCD shall automatically reconfigure into four logical windows.

c. Systems Status Window: The LCD shall show the system time, and the number of active points and disabled points in the system in this section of the LCD Display.

d. Current Event Window: The LCD shall show the first active event of the highest priority in reverse text to highlight the condition to the Emergency Operator. The top line of the reversed text shall show the sequence number in which the displayed event was received, as well as its event type. The second and third lines of reversed text shall display an identification message related to the displayed event.

e. Last Event Window: The LCD shall show the most recent, highest priority event received by the system.

f. Type Status Window: The LCD shall show the total number of active events in the system, by event type. There shall be four different System Event Types which shall be displayed, “Alarm Events”, “Supervisory Events”, “Active Trouble Events”, and “Active Monitor Events”.

g. System Message Processing: In order to simplify, and to clarify the System Status information which is given to the Emergency Operator, the Main LCD shall include queues for each of the System Event Types. The Main LCD shall allow the Emergency operator access to the System Status information contained within those queues by pressing an associated queue select switch. Whenever there is an unacknowledged event in any of the System Event queues, the associated Status LED shall flash. Viewing each event listed in a queue shall acknowledge all events in that queue, and shall cause the associated LED to illuminate steady.

h. Messages contained in the System Event queues shall be accessible for review by the Emergency Operator using the “Previous/Next” message switch. It shall be possible to route additional event information to a printer.

i. Maintenance Menu: The Main LCD shall also allow the System Operator to access system maintenance functions through a four level password system. The authorized System Operator shall be able to access the following functions:

   1). System Status: The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel.

   2). Enable: The system shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system. Additionally, the system shall allow the operator to restore any group function, Panel, system module, “software - defined zone”, operator control, or time control function.

   3). Disable: The system shall allow the operator to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system. Additionally, the system shall allow the operator to disable any group function, Panel, system module, “software - defined zone”, operator control, or time control function within the system.

   4). Activate: The system shall allow the operator to manually turn on any system output point, or system function. Alternate Smoke Detector sensitivity,

message routing within the system and check-in group timings shall be modifiable with this simple command from the control panel.

5). Restore: The system shall allow the operator to restore the primary (application program defined) operation to the Smoke Detector sensitivity and the message routing functions with this simple command from the control panel.

6). Control Output: The system shall allow the operator to manually command and control relays and LEDs. Relays shall be able to be commanded to "Latch", to energize as a "High Priority", or as a "Low Priority", to "Energize", or to "De-Energize".

7). LEDs shall be able to be commanded to "Latch", to energize as a "High Priority", or as a "Low Priority", to turn "On", to turn "Off", to "Slow Blink", or to "Fast Blink".

8). The system shall provide the operator with system reports which give detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the Main LCD, and shall be capable of being printed on any of the connected system printers.

9). The system shall provide a report which gives a sensitivity listing of detectors which have less than 75% environmental compensation remaining.

10). The system shall provide a report which provides a sensitivity listing of any particular detector.

11). The system shall provide a report which gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given SDC loop within any given panel.

12). The system shall provide a report which gives a chronological listing of up to the last 1740 system events.

13). The system shall provide a listing of the firmware revision listings for the installed network components in the system.

6. Program: The system shall allow the authorized operator to perform the following system functions:
   a. Set the System Time.
   b. Set the System Date.
   c. Set (Change) the System Passwords.
   d. Restart the System.
   e. Set the Dates for the System Holiday Schedule.
   f. Clear the Chronological System History File.
7. Test: The system shall allow the authorized operator to perform test functions within the installed system. Test functions shall be defined by the authorized operator to be performed on a per cabinet, circuit, or service group basis.

C. Local Control and Display Annunciators:

1. Each panel in the installed system shall include local Control and Display Annunciators. These annunciators shall have integral membrane style, tactile push-button control

switches, for the control of system functions, and LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.

D. Remote System Display (Point) Annunciators:

1. Each remote display annunciator panel in the installed system shall include remote Control and Display Annunciators. These annunciators shall have integral membrane style, tactile push-button control switches for the control of system functions, and LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events. Coordinate specific control functions to be provided at each display annunciator with Contracting Agency.

E. Life Safety System Operations Interface:

1. SDC Card: The Signature Device Card (SDC) shall be the interface between the Fire Alarm Control Panel and the Signature Series Detectors and Modules. The communications format between the SDC and the Signature Series Devices shall be 100% digital. Communications to devices shall incorporate BROADCAST POLLING and DIRECT ADDRESS SEARCH to ensure the fastest reporting of off-normal conditions to the system human interface layer.
2. It shall be possible to wire the SDC as Class A (Style 6 or Style 7) or Class B (Style 4) without twisted or shielded wire. It shall be possible to wire branch circuits (T-Taps) from Class B Circuits.
3. The associated controller (3-SSDC), through the SDC, shall provide the ability to set the sensitivity and alarm verification of each of the individual intelligent detectors on the circuit. It shall be possible to automatically set the sensitivity of individual intelligent detectors during day and night periods.
4. It shall be possible for the SDC to address all intelligent devices connected to it without having to set switches at the individual devices.
5. It shall be possible to obtain a mapping report of all devices connected to the circuit for confirmation of “as-built” wiring. The map shall show physical wiring of T-Taps, device types, and the panel addresses of devices connected to the circuit. The SDC shall be capable of reporting unexpected additional device addresses and changes to the wiring in the data circuit. A specific trouble shall be reported for any off-normal non-alarm condition.
6. The SDC shall be able to report the following information on a per intelligent device basis:
    a. Device Serial Number.
    b. Device Address.
    c. Device Type.
    d. Current Detector Sensitivity Values and the Extent of Environmental Compensation.
    e. Any of 32 possible trouble codes to specifically diagnose faults.
7. Should a Signature Driver Controller CPU fail to communicate, the Signature circuit shall go into the standalone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during standalone mode.

F. Hard Wired NAC Circuits:

1. Provide where indicated on the plans supervised hard-wired Notification Appliance Circuits (NAC) for the control of 24Vdc EST Genesis Series Signaling Appliances. The NAC shall be wired Class A (Style Z).

G. Life Safety System Programmable Operations: System Message Processing and Display Operations.

1. The Fire Alarm / Life Safety System shall allow Network Routing to be configured to any or all nodes (cabinets) in the network.
2. The system Printer ports shall be configurable to display any or all of the following functions:
   a. Alarm.
   b. Supervisory.
   c. Trouble.
   d. Monitor.
   e. Service Group.
3. Each LCD Display on each node (cabinet) in the system shall be configurable to show the status of any or all of the following functions anywhere in the system:
   a. Alarm.
   b. Supervisory.
   c. Trouble.
   d. Monitor.
4. The system shall provide the capability to label each of the system points with up to 256 characters of location message. The first 42 characters shall be directed to the LCD while the entire message shall be sent to the printer.
5. The system shall have the capability to provide up to 128 logical Counting AND Groups. Each group shall have a programmable ‘activation’ number. Whenever the number of active devices in an AND Group reaches the activation number, the AND Groups’ rules will execute. It shall be possible to ‘overlap’ AND groups by having devices appear in more than one group.
6. The system shall have the ability to define a minimum of 128 Matrix Groups with up to 250 points each. For each matrix, it shall be possible to define a ‘radius’ and an ‘activation’ number. The radius number defines the proximity between detector locations. When two detectors activate at or within the value of the ‘radius’ or whenever the number of active devices reaches the activation number the Matrix Group activates. It shall be possible to ‘overlap’ Matrix groups by having devices appear in more than one group.
7. The system shall include the ability to define an alternate set of device commands which may be used in combination with the system test command for the testing of the connected Signature Series Smoke Detectors. This function shall disable the normal alarm command for each of the members of the group, so that the testing process does not result in an activation of the building evacuation signals, auxiliary relays or central station connections.
8. The system shall include Time Control functions which have the ability to control any system output or function, or initiate any system operational sequence as a function of the Month, Day of Week, Date, Hour, Minute, or Holiday.

9. The system shall include up to 600 software defined Logical Zone Groups which may group any input from any Signature Data Circuit, or other Initiating Device Circuit, in order to control a system output or function, or initiate any system operational sequence. A device or IDC may be a member of one Logical Zone Group. Each of these zones shall have an associated message.

10. The system shall provide the ability to download data from the Signature Series Detectors to a PC while the system is online and operational in the protected premises. The downloaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.

2.6 INTELLIGENT DETECTORS

A. The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Digital filters shall eliminate signal patterns that are not typical of fires. Devices not capable of combining different fire parameters or that do not employ digital filters shall not be acceptable.

B. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and Analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total Analog loop response time for detectors changing state shall be 0.5 seconds.

C. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.

D. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient “Environmental Thresholds” approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24 hour long-term and 4 hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

E. The intelligent Analog device and the Analog loop controller shall provide increased reliability and inherent survivability through intelligent Analog standalone operation. The device shall automatically change to standalone conventional device operation in the event of a loop controller polling communications failure. In the Analog standalone detector mode, the Analog detector shall continue to operate using sensitivity and environmental compensation information stored in its microprocessor at the time of communications failure. The Analog loop controller shall monitor the loop and activate a loop alarm if any detector reaches its alarm sensitivity threshold.

F. Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches.

G. The intelligent Analog detectors shall be suitable for mounting on any Signature Series detector-mounting base.

1. Fixed Temperature Heat Detector, SIGA-HFS: Provide intelligent fixed temperature heat detectors (SIGA-HFS). The heat detector shall have a Low Mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

2. Fixed Temperature/Rate of Rise Heat Detector, SIGA-HRS: Provide intelligent combination fixed temperature/rate-of-rise heat detectors (SIGA-HRS). The heat detector shall have a Low Mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

3. Photoelectric Smoke Detector, SIGA-PS Provide intelligent photoelectric smoke detectors (SIGA-PS). The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:

   a. Temperature: 32°F to 120°F (0°C to 49°C).

   b. Humidity: 0-93% RH, non-condensing.

   c. Elevation: no limit.

4. 3D Multisensor Detector, SIGA-PHS: Provide intelligent 3D multisensor smoke detectors (SIGA-PHS). The multisensor analog detector shall use a light scattering type photoelectric smoke sensor and a fixed temperature type heat sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time-based algorithms to dynamically examine values from both sensors simultaneously and initiate an alarm based on that data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in

sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. Separately mounted photoelectric detectors and heat detectors in the same location are not acceptable alternatives. The 3D Multisensor detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The fixed temperature alarm set point shall be 135°F (57°C) nominal. The 3D Multisensor detector shall be suitable for operation in the following environment:

a. Temperature: 32°F to 100°F (0°C to 38°C).

b. Humidity: 0-93% RH, non-condensing.

c. Elevation: no limit.

5. 4D Multisensor Detector, SIGA-IPHS: Provide intelligent 4D multisensor smoke detectors (SIGA-IPHS). The multisensor analog detector shall use a light scattering type photoelectric smoke sensor, a unipolar ionization smoke sensor and an ambient temperature sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time-based algorithms to dynamically examine values from the three sensors simultaneously and initiate an alarm based on that data. The 4D Multisensor shall be capable of adapting to ambient environmental conditions. The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input an alarm when there is a change of 65°F (35°C) in ambient temperature. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, age and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. Separately mounted photoelectric detectors, ionization detectors and heat detectors in the same location are not acceptable alternatives. The 4D Multisensor smoke detector shall be rated for ceiling installation at a minimum of 30-ft (9.1m) centers and suitable for wall mount applications. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The integral heat sensor shall cause an alarm when it senses a change in ambient temperature of 65°F (35°C) or reaches it fixed temperature alarm set point of 135°F (57°C) nominal. The 4D Multisensor detector shall be suitable for operation in the following environment:

   a. Temperature: 32°F to 100°F (0°C to 38°C).

   b. Humidity: 0-93% RH, non condensing.

   c. Elevation : Up to 6,000 ft (1828 m).

6. Standard Detector Mounting Bases, SIGA-SB / SIGA-SB4: Provide standard detector mounting bases (SIGA-SB or SIGA-SB4 as required). The base shall, contain no electronics, support all Signature Series detector types and have the following minimum requirements:

   a. Removal of the respective detector shall not affect communications with other detectors.

   b. Terminal connections shall be made on the room side of the base. Bases that must be removed to gain access to the terminals shall not be acceptable.

c. The base shall be capable of supporting one (1) Signature Series (SIGA-LED) Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

7. Relay Detector Mounting Bases, SIGA-RB / SIGA-RB4: Provide relay detector mounting bases (SIGA-RB or SIGA-RB4 as required). The relay base shall support all Signature Series detector types and have the following minimum requirements:

   a. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.

   b. The position of the contact shall be supervised.

   c. The detector processor upon power up shall exercise the relay operation.

   d. The relay shall automatically de-energize when a detector is removed.

   e. Its respective detector processor shall control the operation of the relay base. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.

   f. Form “C” Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for “pilot duty”.

   g. Removal of the respective detector shall not affect communications with other detectors.

   h. Terminal connections shall be made on the room side of the base. Bases that must be removed to gain access to the terminals shall not be acceptable.

8. Duct Detector, SIGA-SD: Provide smoke detector duct assemblies (SIGA-SD). Provide for variations in duct air velocity between 300 and 4000 feet per minute. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Provide remote alarm test station (SIGA-TRK) as shown on the plans or if required by the installation.

2.7 INTELLIGENT MODULES

A. It shall be possible to address each Intelligent Signature Series module without the use of DIP or rotary switches. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes that can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

   1. Temperature: 32°F to 120°F (0°C to 49°C).

   2. Humidity: 0-93% RH, non-condensing.

B. Single Input Module, SIGA-CT1:

   1. Provide intelligent single input modules (SIGA-CT1). The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The single input module shall support the following circuit types:

a. Normally-Open Alarm Latching (Manual Fire Alarm Boxes, Heat Detectors, etc.).

b. Normally-Open Alarm Delayed Latching (Waterflow Switches).

c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.).

d. Normally-Open Active Latching (Supervisory, Tamper Switches).

C. Dual Input Module, SIGA-CT2:

1. Provide intelligent dual input modules (SIGA-CT2). The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The dual input module shall support the following circuit types:

a. Normally-Open Alarm Latching (Manual Fire Alarm Boxes, Heat Detectors, etc.).

b. Normally-Open Alarm Delayed Latching (Waterflow Switches).

c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.).

d. Normally-Open Active Latching (Supervisory, Tamper Switches).

D. Monitor Module, SIGA-MM1:

1. Provide intelligent monitor modules (SIGA-MM1). The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit.

E. Waterflow/Tamper Module, SIGA-WTM or SIGA-CT2:

1. Provide intelligent waterflow/tamper modules (SIGA-WTM, CT2). The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch.

F. Single Input Signal Module, SIGA-CC1:

1. Provide intelligent single input signal modules (SIGA-CC1). The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own “ring tone. The single input signal module shall support the following operations:

a. Audible/Visible Signal Power Selector (Polarized 24 VDC @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio).

b. Telephone Power Selector with Ring Tone (Fire Fighters Telephone).

G. Dual Input Signal Module, SIGA-CC2:

1. Provide intelligent dual input signal modules (SIGA-CC2). The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The dual input signal module shall support the following operation:

a. Audible/Visible Signal Power Selector (Polarized 24 VDC @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio).

H. Control Relay Module, SIGA-CR:

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

I. Universal Class A/B Module, SIGA-UM:

1. Provide intelligent class A/B modules (SIGA-UM). The Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The universal class A/B module shall support the following circuit types:

a. Two (2) supervised Class B Normally-Open Alarm Latching.

b. Two (2) supervised Class B Normally-Open Alarm Delayed Latching.

c. Two (2) supervised Class B Normally-Open Active Non-Latching.

d. Two (2) supervised Class B Normally-Open Active Latching.

e. One (1) form "C" dry relay contact rated at 2 amps @ 24 VDC.

f. One (1) supervised Class A Normally-Open Alarm Latching.

g. One (1) supervised Class A Normally-Open Alarm Delayed Latching.

h. One (1) supervised Class A Normally-Open Active Non-Latching.

i. One (1) supervised Class A Normally-Open Active Latching.

j. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.

k. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified.

l. One (1) supervised Class A 2-wire Smoke Alarm Verified.

m. One (1) supervised Class B 2-wire Smoke Alarm Verified.

n. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.

o. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A.

2.8 INTELLIGENT MANUAL FIRE ALARM BOX

A. It shall be possible to address each Signature Series fire alarm box without the use of DIP or rotary switches. The manual fire alarm box shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The manual fire alarm box shall be capable of storing up to 24 diagnostic codes that can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults. The manual fire alarm box shall be suitable for operation in the following environment:

1. Temperature: 32°F to 120°F (0°C to 49°C).

2. Humidity: 0-93% RH, non-condensing.

B. Double Action Manual Fire Alarm Box, SIGA-278:

1. Provide intelligent double action, single stage manual fire alarm box (SIGA-278). The manual fire alarm box shall be of Lexan construction with an internal toggle switch. Provide a key locked test feature. Finish the manual fire alarm box in red with white "PULL IN CASE OF FIRE" lettering.

C. Manual Fire Alarm Box Covers:

1. Provide manual fire alarm box cover, STI "Stopper II", over each manual fire alarm box, unless otherwise noted. They shall consist of a tamper-proof; clear Lexan polycarbonate shield and frame suitable for mounting over flush-mounted or surface-mounted manual fire alarm boxes. The cover shall contain an integral horn that will sound an 85 db warning tone when the cover is lifted. The power source shall be a 9-volt dc alkaline battery included with the unit.

2.9 CONVENTIONAL FIRE ALARM INITIATING DEVICES

A. Double-Action Manual Fire Alarm Box

1. Provide double action, single stage manual fire alarm box with screw terminals (278B series) for connection of installation wiring. All manual fire alarm boxes shall be break glass type and shall be constructed of red Lexan with white raised letters.

2. The alarm handle shall be marked "PULL FOR FIRE", to provide simple, concise instructions for activation of the manual fire alarm box by the general public. It shall be necessary to first lift an upper door marked "LIFT THEN PULL HANDLE" to gain access the alarm handle. Pulling the alarm handle shall break a glass rod and activate a toggle switch that shall cause the handle to latch in the alarm position. Momentary push button type switches shall not be acceptable. To reset the station it shall be necessary to open the station using a key or a special tool, restore the toggle switch to its normal position and replace the glass rod.

B. Heat Detectors:

1. Combination Fixed Temperature/Rate-of-Rise Heat Detectors, 281B, 282B:

a. Provide low profile heat detectors rated for a maximum smooth ceiling rating of (2500 sq. ft., 232 m2). The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at 15°F (9°C) per minute rate-of-rise and 135°F (57°C) fixed temperature.

2. Fixed Temperature Heat Detectors, 283B, 284B:

a. Provide low profile heat detectors rated for a maximum smooth ceiling rating of (2500 sq. ft., 232 m2). The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at 135°F (57°C) fixed temperature

C. Smoke Detectors:

1. Ionization Smoke Detectors, EC10U-3 Series:

a. Provide stable, solid state, unipolar ionization detectors capable of detecting visible and invisible products of combustion. Provide the detectors with a measuring chamber and a protected reference chamber sensitive to changes in temperature and humidity only. Protect the measuring chamber from damage and insects. Provide a built-in five second delay to minimize alarms due to transient smoke. Safeguard radioactive parts and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal.

b. Factory set the detector sensitivity and provide for field adjustment within the range of ULI defined sensitivity. The detector shall be tamper resistant plug mounted to a separate base. A built-in shorting device shall permit checking of the installation wiring before detector installation. Provide a concealed test switch to allow full logical testing without the use of smoke or aerosol spays.

2. Photoelectric Smoke Detectors, EC30U-3 Series:

   a. Provide stable, solid state, photoelectric detectors capable of detecting visible products of combustion. Provide the detectors with self-compensating circuitry to protect its stability against the effects of aging, dust and film accumulation. Protect the measuring chamber from damage and insects. Provide a built-in five second delay to minimize alarms due to transient smoke. Safeguard and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal.

   b. Factory set the detector sensitivity. The detector shall be tamper resistant plug mounted to a separate base. A built-in shorting device shall permit checking of the installation wiring before detector installation. Provide a concealed test switch to allow full logical testing without the use of smoke or aerosol spays.

D. Air Duct Smoke Detectors, SD-2W:

1. Provide stable, solid state, photoelectric (SD-2W) air duct smoke detector heads capable of detecting visible and invisible products of combustion. Provide the detectors with a measuring chamber and a protected reference chamber sensitive to changes in temperature and humidity only. Protect the measuring chamber from damage and insects. Provide a built-in five second delay to minimize alarms due to transient smoke.

2. Variations in duct air velocity between 400 and 4,000 FPM (2 and 20.3 m/sec.) shall not cause any false alarms. Safeguard radioactive parts and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal. Factory set the detector sensitivity. Mount the detector head in an enclosure suitable for mounting to a air duct. Provide an air sampling tube that extends into the duct air stream. Provide a LED alarm indicator on the enclosure.

2.10 NOTIFICATION APPLIANCES

A. General

1. Appliances shall be U.L. Listed for Fire Protective Service.

2. Strobe appliances or combination appliances with strobes shall be capable of providing the “Equivalent Facilitation” which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971, and ULC S526 Listed.

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

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

5. Initial settings for all devices with field selectable settings shall be set in accordance with the values indicated on the Drawings. Values shall be included on the Shop Drawing and As-built Drawing submittals.

B. Synchronized Strobes

1. Strobes shall flash at a rate of one flash per second and shall be synchronized indefinitely within 10 milliseconds of other strobes per UL 1971 Standard.

2. Indoor Wall Mounted Strobes, Genesis Series: Provide strobes manufactured by EST. In - Out screw terminals shall be provided for wiring. The strobes shall have a white face plate. They shall provide field configurable 15 cd, 30 cd, 75 cd or 110 cd synchronized flash outputs as required by the application. The strobe shall have lens markings oriented for wall mounting.
3. Indoor Ceiling Mounted Strobes, Genesis Series: Provide strobes manufactured by EST. In - Out screw terminals shall be provided for wiring. The strobes shall have a white face plate. They shall provide field configurable 15 cd, 30 cd, 75 cd or 95 cd synchronized flash outputs as required by the application. High output strobes shall provide field configurable 95 cd, 115 cd, 150 cd or 177 cd synchronized flash outputs as required by the application

C. Horn/Strobes

1. Horn/strobes shall flash at a rate of one flash per second and shall be synchronized indefinitely within 10 milliseconds of other strobes per UL 1971 Standard.
2. Indoor Wall Mounted Horn/Strobes, Genesis Series: Provide horn/strobes manufactured by EST. In - Out screw terminals shall be provided for wiring. The horn/strobes shall have a white face plate. They shall provide field configurable 15 cd, 30 cd, 75 cd or 110 cd synchronized flash outputs as required by the application. Horn shall be field selectable for low or high output.
3. Indoor Ceiling Mounted Horn/Strobes, Genesis Series: Provide horn/strobes manufactured by EST. In - Out screw terminals shall be provided for wiring. The horn/strobes shall have a white face plate. They shall provide field configurable 15 cd, 30 cd, 75 cd or 95 cd synchronized flash outputs as required by the application. High output strobes shall provide field configurable 95 cd, 115 cd, 150 cd or 177 cd synchronized flash outputs as required by the application. Horn shall be field selectable for low or high output.

D. Outdoor Horn/Strobes

1. Temporal Horn/Strobes, 757 Series
   a. Provide electronic horn/strobes manufactured by EST, Cat. No. 757 Series. In - Out screw terminals shall be provided for wiring. The horn/strobe shall have a red plastic housing. Horn/strobes shall be selectable for high or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible.
   b. The strobe shall provide 15/75 cd synchronized flash output as required by the application. The strobe shall have lens markings oriented for wall mounting.
   c. Provide weatherproof wall boxes for outdoor mounting.

E. Sprinkler Bell:

1. Provide electrically operated, 10 inch diameter, red color alarm gong with “Call Fire Dept.” sign. Refer to mechanical drawings for locations. Coordinate exact mounting height and location with the Architect. EST 439D-10AW on weatherproof back box.

F. Booster Power Supplies (BPS), EST BPS6A or BPS10A:

1. Provide, where required, GE Security, EST BPS6A booster power supplies as an extension of the Notification appliance circuits. The Booster Power Supplies, (BPS), units shall incorporate its own standby power supply capable of providing 24 hours of

standby power followed by 5 minutes of alarm. The BPS shall be able to charge a 24 Amp Hour battery.

2. The BPS shall incorporate four independently supervised notification appliance circuits, (NAC). It shall be possible to configure the NACs so that they will follow the main FACP signal circuit's output or be activated and synchronized across the entire building via use of an EST SIGA-CC1S addressable module. The BPS shall be configurable to operate independently at any one of the following rates: continuous, 3-3-3 temporal, or code follower.

3. The BPS units shall have four configurable outputs that can be used for NAC control, or 24 volt DC power output for door holders, door locks or fan control power. Any of the circuits in the BPS shall be individually programmed to provide either 24 Volt DC NAC supervision and signal initiation or as a power riser for auxiliary control of Fire Alarm devices.

2.11 ANCILLARY DEVICES

A. Remote Relays:

1. Multi Voltage Control Relays, MR-100 Series: Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 VAC. A single relay may be energized from a voltage source of 24 VDC, 24 VAC, 115 VAC, or 230 VAC. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

2. Multi Voltage Control Relays, MR-200 Series: Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 VDC, 24 VAC, 115 VAC, or 230 VAC. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

2.12 ELECTROMAGNETIC DOOR HOLDERS, 1500 SERIES

A. Provide electromagnetic door holders with the following features.

1. Flush mounted wall units or floor units as required by door and application.
2. Silent operation.
3. Minimum 25 Lbf. (111 Nt) holding force.
4. 120V 60Hz operation.
5. Finish shall be brushed zinc.
6. EST 1500 Series.

2.13 SYSTEM MAP

A. On wall beside Fire Alarm Control Panel, provide system map, framed under clear 1/8 inch plexiglass. Map shall consist of a basic floor plan of the entire building.

B. Orient map in a manner that is consistent with the building. Rotate graphic layout and map as required to show North, South, East, and West as it applies to the specific building.

C. Map shall show the location of every fire alarm initiating device in the building.

2.14 CONDUCTORS

A. In general, conductors shall be of the sizes and types recommended by the system manufacturer.

B. Voltage drop on Notification Appliance Circuits shall not exceed 10% at the most distant device on each circuit.

2.15 **SPARE CAPACITY**

A. Signaling Line Circuits and Notification Appliance Circuits shall be sized to provide 20% spare capacity to allow future addition of devices.

2.16 **SECONDARY SUPPLY CAPACITY AND SOURCES**

A. Standby battery capacity shall have sufficient capacity to operate the system under maximum quiescent load (system functioning in a non-alarm condition) for a minimum of 60 hours; and, at the end of that period, shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes.

B. The secondary supply shall consist of the following:

1. A storage battery arranged in accordance with NFPA 72.

2. Operation on secondary power shall not affect the performance of the fire alarm system.

PART 3 - EXECUTION

3.1 **INSTALLATION (GENERAL)**

A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturer's manuals and wiring diagrams. Furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. Wiring shall be of the type recommended by the NEC, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.

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

C. Mount the Fire Alarm Control Panel enclosures in the locations shown on the Drawings.

D. Field coordinate exact mounting locations.

1. Where field conditions (such as conflicts with other features, obstructions that violate the placement rules of the applicable Fire Code, and the like) make necessary the relocation of detectors from the positions shown on the plans, such relocations shall be made in strict accordance with the applicable Fire Code, and shall be made at no additional cost to the Owner.

2. As far as possible within the rules of the applicable Fire Code, the final placement of exposed detectors shall present a uniform appearance.

E. Wall mounted devices in finished areas such as manual fire alarm boxes and notification appliances shall be recessed in flush mounted junction boxes. Surface mounted box extensions shall not be used.

F. Adjust each detector in accordance with manufacturer's recommendations for the specific location and circumstance.

G. Detectors shall be installed a minimum of 3 feet from any supply or return air diffuser.

H. Control functions which include outputs activated by specific inputs, such as door releases, elevator recall, fan shutdown, damper operation, etc., shall have both inputs and associated

outputs connected to the same control panel. Control functions shall be accomplished with addressable control modules. Control through relay bases is not acceptable.

I. Relays shall be located within three feet of the device or circuit controlled or monitored in accordance with NFPA 72.

J. Coordinate exact mounting locations with the reflected ceiling plans. Coordinate exact mounting heights with architectural elevations.

K. Provide 3/4 inch C.O. with pull string between Fire Alarm Control Panel (FACP) and Telephone Terminal Board (TTB) for future use. This conduit shall be in addition to any conduits required for this project.

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

3.2 SYSTEM WIRING

A. Wiring shall be in metal raceways shared by no other system. Raceways shall be installed in accordance with Section 26 0533 - Conduit and Fittings. Fire alarm conduit shall be identified in accordance with Section 26 0533 - Conduit and Fittings.

B. Field devices shall be installed in accordance with Section 16131 - Outlet Boxes. Paint boxes and covers red.

C. Install Conductors in accordance with Section 26 0519 - Wire and Cable. No wire nuts shall be used. Wires shall be landed on device terminals, or terminal strips or blocks, and shall be labeled and numbered at their terminations. Wiring shall be installed in a neat and workmanlike manner. Bundles of wiring shall be secured with self-locking nylon cable ties, not tape. If terminal strips or blocks are required to transition wire size down at devices, they shall not be located in the device junction box unless adequate space is available. Surface mounted box extensions shall not be used at recessed device locations to provide adequate room. If required, locate terminal strips or blocks in properly sized, separate junction boxes, located in accessible ceiling spaces. Clearly mark covers of junction boxes per Section 26 0000 - Electrical General Requirements.

3.3 DUCT DETECTORS

A. Smoke dampers and fire/smoke dampers: Coordinate installation of duct-mounted detectors for control of smoke dampers and smoke/fire dampers with Divisions 21, 22 and 23 and the Contracting Agency. Locate duct mounted smoke detectors within five feet of smoke/fire dampers with no air inlets or outlets between detector and damper. Damper shall close when smoke detector goes into alarm.

B. Air Handling Units: Coordinate installation of duct-mounted detectors with Divisions 21, 22 and 23 and the Contracting Agency. Duct detectors shall be located in accordance with NFPA 72 and manufacturer's recommendation to the greatest extent practical. Proposed duct detector locations shall be submitted for approval prior to installation of any equipment. Submit duct detector differential pressure measurements to verify proper operation of duct detectors.

C. Provide remote test stations for all duct mounted smoke detectors. Provide a descriptive label in accordance with Section 26 0000 - Electrical General Requirements - IDENTIFICATION. Field coordinate location of remote test stations with the Contracting Agency.

3.4 MAGNETIC DOOR HOLDERS

A. Unless otherwise noted or specified or dictated by the specified holder design, magnetic door holders shall be mounted near the top of the doors they serve, and within 6 inches of the latch-side edge of each door served. Provide backing attached to wall studs to support door holder junction box.

B. Door holders shall produce no objectionable hum. Repair, replace, or relocate holders that produce audible hum.

3.5 PROTECTION OF FIRE ALARM CONTROL UNITS

A. Provide automatic smoke detection at the location of each fire alarm control unit(s) including fire alarm control panels, remote power supplies and remote booster power supplies.

3.6 DOOR UNLOCKING DEVICES

A. Any device or system intended to effect the locking/unlocking of emergency exits shall be connected to the building fire alarm system. These exits shall unlock upon receipt of any fire alarm signal.

3.7 INTERCONNECTIONS TO OTHER SYSTEMS

A. Provide new input modules for monitoring of sprinkler flow, tamper, and low air pressure switches. Provide sufficient modules to give each switch an individual address. Connect supervised circuits from modules to switches and program system to provide specified functions for each switch.

B. Monitor pre-action sprinkler control panels for sprinkler flow, tamper and low pressure conditions. Provide output from fire alarm system to pre-action panel to operate pre-action valve to charge sprinkler piping when a minimum of two smoke detectors in the covered area go into alarm.

3.8 PROGRAMMING

A. Provide system programming as required for operation of system as specified. Submit device locations and numbering scheme for approval prior to programming device descriptions.

B. Reprogram system after substantial completion to make any Owner requested changes and to optimize system performance. Provide additional reprogramming during warranty period as required for proper system operation.

3.9 TESTING AND REPORTS

A. Upon completion of the system installation, an Approved representative of the system manufacturer shall conduct a thorough test of the system and all related devices and components of the system, and submit a written report of the findings to the Contracting Agency The testing shall include, at the least, verification of the following:

1. The functional operation of each resettable initiating device (manual fire alarm boxes, detectors, etc.) and circuit.
2. The functional operation of each and every alarm device and circuit.
3. The functional operation of each monitored device circuit.
4. The functional operation of each control and output circuit.
5. The supervision function of each Initiating, Indicating, Monitoring, Control and Supply Circuit.

6. Central Station automatic signaling.
7. Proper initiation and execution of mechanical systems control sequences.
8. Verify that wire size, power supply, number of devices on a circuit, etc. are suitable to support 100% of devices being in alarm or operated simultaneously. Test shall include the following as a minimum:
   a. Place all detectors and monitor modules in alarm. Each shall display its address and alarm condition. At least the first ten devices on each circuit shall also have their alarm LEDs lighted, where applicable.
   b. Operate all control modules for the alarm or operated condition. Each module shall display its address and condition.
   c. Reset all alarmed and operated devices. The panel shall display the address of any off-normal devices.
9. Test a representative number of detector for trouble by removing the detector from its base. The address and trouble condition for each shall be displayed. Insert a different type of detector into the base. The address and trouble condition shall be displayed. The detector shall return to normal only when the proper detector type is reinserted into the base.
10. Print out the English-language descriptor, currently sensed value, prealarm threshold value, alarm threshold value and status of each sensor in the system. Also print out the English-language descriptor and status of each module in the system. The printout shall also include the date and time.

3.10 TRAINING

A. After the system provided in this Section is completely installed and operational, and at a time chosen by the Owner, provide the Owner's system operators and maintenance personnel and representatives of the local Fire Department with a total of eight (8) hours of instruction on the operation, maintenance, and troubleshooting of all equipment provided under this Section.

B. Training sessions shall be presented by a fully qualified, trained representative of the equipment manufacturer, who is thoroughly knowledgeable on the specific installation. Separate sessions shall be given for operation personnel (i.e.: facility staff and Fire Department) and maintenance personnel, with the length and content of the sessions tailored to the respective groups.

C. Provide an additional two (2) hours of follow-up instruction for review and clarification at a later time mutually agreed on with the Owner, if the Owner deems it necessary.

3.11 SPARE COMPONENTS

A. Furnish to Owner the following spare components: Two replacement elements for each rating of non-resettable fixed-temperature heat detector, one area smoke detector, one duct-mounted smoke detector (less housing), and one horn/strobe signal of each rating. All spare components shall be available on-site for inventory at the time of final inspection.

3.12 ACCEPTABLE INSTALLERS

A. The Fire Alarm / Life Safety System specified herein shall be installed by a Factory Trained and Authorized Engineered Systems Distributor.

B. Field Connected Devices may be installed and wired by licensed contractors under the direct supervision of a Factory Trained and Authorized Engineered Systems Distributor. Installation

shall be supervised and tested by trained representatives of the manufacturer of the system equipment who shall have a State fire alarm license.

3.13 **EXAMINATION**

A. Prior to the commencement of any of the work detailed herein, an examination and analysis of the area(s) where the Fire Alarm / Life Safety System and associated components are to be installed shall be made.

B. Any of these area(s) which are found to be outside the manufacturers' recommended environments for the particular specified products shall be noted on a Site Examination Report which shall be given to Contracting Agency.

C. Shorts, opens, or grounds found on existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

3.14 **DEMONSTRATION**

A. Each of the intended operations of the installed Fire Alarm / Life Safety System shall be demonstrated to the Contracting Agency and the Local Authority Having Jurisdiction by the Installing Engineered System Distributor.

END OF SECTION 28 3100

SECTION 31 1000
SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing or abandoning site utilities.
7. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

C. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.03 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Protection Zone: Area within five feet of individual trees or groups of trees to be protected during construction and indicated on Drawings:

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 MATERIAL OWNERSHIP

A. Cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.07 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises within 5 miles of the project location.

C. Utility Locator Service: Notify utility locator service and City of Unalaska for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. Protect existing trees during clearing and construction activities.

F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 2000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.04 EXISTING UTILITIES

A. Owner will shutoff water, sewer, or electric utilities on the service side of the meter or proper line that serve existing structures before site clearing, when requested by Contractor. Contractor shall disconnect and seal indicated utilities on site.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: 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:

1. Notify Architect not less than five days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 02 4100 "Demolition”

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Use only hand methods or air spade for grubbing within protection zone.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to full depth in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 2000
EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Subbase and Base course for concrete slabs-on-grade, walks, and pavements.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
1. Section 03 3000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
2. Section 31 1000 "Site Clearing" for site stripping, grubbing, stripping [**and stockpiling**] topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 31 5000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 32 9000 "Planting" for finish grading in planting areas and tree and shrub pit excavation and planting.
5. Section 32 9200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subbase course and slabs-on-grade, concrete walks and pavements, and asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe as well as beside and over the pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Site includes organics, silts, ash, fill, cobbles, and rock. See project geotechnical report for subsurface conditions.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Material: Aggregate layer placed between the subgrade and base course, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
2. Geofoam.
3. Warning tapes.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.06 QUALITY ASSURANCE

A. Geotechnical Testing provided by Owner.

1.07 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service and City of Unalaska for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

D. Do not commence earth-moving operations until plant-protection measures are in place.

E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Plasticity Index: equal or less than 6.0%

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 6 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 6 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 6 percent passing a No. 200 sieve.

G. Sand: ASTM C 33/C 33M; fine aggregate.

2.02 GEOTEXTILES

A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Survivability: As follows:
      a. Grab Tensile Strength: 247 lbf; ASTM D 4632.
      b. Sewn Seam Strength: 222 lbf; ASTM D 4632.
      c. Tear Strength: 90 lbf; ASTM D 4533.
      d. Puncture Strength: 90 lbf; ASTM D 4833.
   3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
   4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
   5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 GEOFOAM

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.80-lb/cu. ft. density, 40-psi compressive strength.

2.04 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated in the drawings.

B. Classified Excavation: Excavate to subgrade elevations.
   1. Excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and rock.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Cut and protect roots.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the clearances indicated in drawings. Excavate trench walls as vertically as allowed per OSHA standards.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.

D. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

E. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
   3. Cut and protect roots.

3.08 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs, walks, and pavements <Insert locations> with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons**, a 10-ton vibratory roller, or other mean acceptable to the Architect to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring, bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 3000 "Cast-in-Place Concrete."

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Initial Backfill:
   1. Soil Backfill: Place and compact initial backfill of bedding material to a height of 6 inches over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill:
1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Warning Tape: Install detectable warning tape directly above utilities as indicated in drawings.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as indicated in the drawings.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1/2 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place base course material over subbase course under pavement, walks, and slabs-on-grade.
   3. Shape subbase course and base course to required crown elevations and cross-slope grades.
   4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections. These inspections are not intended as a substitute for the contractor’s quality control program. Special inspections may include:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material classification and maximum lift thickness comply with requirements.
   3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.
   4. Testing frequencies may be increased or decreased at the sole discretion of the Architect.

F. In lieu of the requirements of Subsection 3.18.E E, Architect may accept, at their sole discretion, visual inspection of compaction based on a level of effort demonstrated to achieve required densities.

G. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 5000
EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:
   1. Section 31 2000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.
   1. Include plans, elevations, sections, and details.
   2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
   3. Indicate type and location of waterproofing.
   4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.05 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Architect's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
   1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
   2. The geotechnical report is included elsewhere in Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
   1. Provide support and protection system when required by field conditions or OSHA requirements.
   2. When supporting excavations greater than five feet in depth, provide a drawings and calculations reviewed and stamped by a professional engineer registered in the state of Alaska.
   3. Prevent surface water from entering excavations by grading, dikes, or other means.
   4. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
   5. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.02 MATERIALS

A. General: Provide materials that are either new or in serviceable condition and structurally sufficient for the support and protection required.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
   1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.02 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
   2. Install internal bracing if required to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.03 FIELD QUALITY CONTROL

A. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

B. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.04 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems below overlying construction.
   2. Fill voids immediately with approved backfill compacted to density specified in Section 31 2000 "Earth Moving."
   3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION

SECTION 32 1216
COLD ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cold-mix asphalt patching.
2. Cold-mix asphalt paving.

B. Related Requirements:

1. Section 02 4100 "Demolition" for demolition and removal of existing asphalt pavement.
2. Section 31 2000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 32 1313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 32 1373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer with at least 10-years' experience manufacturing cold-asphalt mix.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

1.06 FIELD CONDITIONS

Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 40 deg F.
2. Asphalt Surface Course: Minimum surface temperature of 40 deg F at time of placement.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. The EZ Street Company.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.03 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying cold-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Fill excavated pavement areas with cold-mix asphalt base mix for full thickness of patch and compact flush with adjacent surface.

3.04 SURFACE PREPARATION

A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying cold-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C.

3.05 PLACING HOT-MIX ASPHALT

A. Place cold-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place cold-mix asphalt surface course in single lift.
2. Spread mix at a minimum ambient temperature of 40 deg F and rising.
3. Place cold-mix asphalt to cover the entire paving width prior to compacting.
4. If multiple strips are required, begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.

B. Promptly correct surface irregularities in paving prior to compaction and during compaction as necessary. Use suitable hand tools to remove excess material forming high spots. Fill depressions with cold-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.06 JOINTS

A. Avoid joints except where necessary for construction. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of cold-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Saw-cut these joints prior to resuming paving operations.
5. Compact asphalt at joints to a density within 2 percent of specified course density.

3.07 COMPACTION

A. General: Compact cold-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before ambient temperature cools to 32 deg F.

B. Rolling: Vibratory roll until cold-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.

C. Finish Rolling: Finish roll paved surfaces to remove roller marks.

D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment.

E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, cold-mix asphalt. Compact by rolling to specified density and surface smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement for 4 hours.

3.08 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Surface Course: 1/4 inch.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of cold-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each cold-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will observe all compaction effort and consider the density acceptable based on a level of effort that demonstrates the density does not improve with additional effort.

E. Remove and replace or install additional cold-mix asphalt where paving does not comply with specified requirements.

3.10 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 01 7419 "Construction Waste Management and Disposal."

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

Section Includes Concrete Paving, including the following:

1. Parking lots.
2. Curbs and gutters.
3. Walks, Sidewalks, and Plazas.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for general applications requirements of concrete including action submittals, informational submittals, quality assurance, cold weather procedures, concrete products, concrete mix, reinforcement, testing, and as indicated in this section.
2. Section 32 1373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section 32 1723 "Pavement Markings."
4. Section 32 1726 "Tactile Warning Surfacing" for detectable warning tiles.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

2.02 FORMS

Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”, except:

1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

    a. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

2.03 STEEL REINFORCEMENT

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

2.04 CONCRETE MATERIALS

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

2.05 CURING MATERIALS

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”, except do not use curing compounds.

2.06 RELATED MATERIALS

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

2.07 CONCRETE MIXTURES

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete” for exterior flatwork.

2.08 CONCRETE MIXING

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT INSTALLATION

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 35 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to the radius indicated on the drawings. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to the radius indicated on the drawings. Repeat tooling of edges after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

B. Screed paving surface with a straightedge and strike off.

C. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

D. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.
Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface by hand floating. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 DETECTABLE WARNING INSTALLATION

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 32 1726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 32 1726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

3.09 CONCRETE PROTECTION AND CURING

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”, except do not use curing compounds.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 1/3 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Comply with requirements of Section 03 3000 “Cast-in-Place-Concrete”.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for the greater of 14 days after placement or until concrete has reached 80% of specified compressive strength as demonstrated by testing field samples. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 1373
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Joint-sealant backer materials.
4. Primers.

B. Related Requirements:

1. Section 07 9200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.04 INFORMATIONAL SUBMITTALS

A.

B. Product Certificates: For each type of joint sealant and accessory.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.06 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer[**or are below 40 deg F**].
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.02 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type IV.

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

a. Crafco Inc.
b. W.R. Meadows, Inc.

2.03 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.04 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.05 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:

   a. Expansion and isolation joints in concrete paving.
   b. Contraction joints in concrete paving.
   c. Other joints as indicated.

2. Joint Sealant: Hot-applied, single-component joint sealant.
3. Joint-Sealant Color: Manufacturer's standard.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1. Joint Location:

   a. Joints between concrete and asphalt paving.
   b. Joints between concrete curbs and asphalt paving.
   c. Other joints as indicated.

2. Joint Sealant: Hot-applied, single-component joint sealant.
3. Joint-Sealant Color: Manufacturer's standard.

END OF SECTION

SECTION 32 1723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.

B. Related Requirements:
1. Section 09 9113 "Exterior Painting" for painting exterior concrete surfaces other than pavement.
2. Section 09 9123 "Interior Painting" for painting interior concrete surfaces other than pavement.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking pavement including, but not limited to, the following:

a. Pavement aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.05 QUALITY ASSURANCE

A. Personnel: Contractor shall have at least one individual on site with at least five years of experience applying pavement markings. That individual shall be responsible for maintaining the quality of the Contractors work.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Aexcel Inc.
2. Ennis-Flint.
3. PPG Paints.
4. Sherwin-Williams Company (The).

2.02 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.03 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Color: As indicated.

B. Pavement-Marking Paint: Acrylic Emulsion, exterior Latex complying with A-A-3183; colors complying with FS TT-P-1952.

1. Color: As indicated.

C. Glass Beads: AASHTO M 247, Type 1.

1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING REMOVAL

A. Pavement markings shall be removed to the fullest extent possible from the pavement by any method that does not materially damage the surface or texture of the pavement or surfacing. Sand or other material deposited on the pavement as a result of removing traffic stripes and markings shall be removed as the Work progresses. Accumulations of sand or other material which might interfere with drainage or might constitute a hazard to traffic are not permitted.

B. Painting over markings is prohibited.

3.03 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Do not apply pavement markings until existing pavement marking have been removed.

C. Allow paving to age for the minimum number of days recommended by the paint manufacturer before starting pavement marking.

D. Sweep and clean surface to eliminate loose material and dust.

E. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..

F. Tolerance of striping: The Contractor shall keep striping within the following tolerances:

1. Length of Stripe. The longitudinal error within a twenty foot (20') length of line shall not be more than plus or minus two inches (±2").
2. Width of Stripe. The width of stripe shall not vary more than plus or minus one-half inch (±1/2").
3. Stall Width. The width of stalls shall not vary more than plus or minus four inches (±4") from the widths shown on the Drawings, measured between the centers of adjacent lane lines.

G. Traffic markings not within the above tolerances will be considered unacceptable under this Section and shall be replaced by the Contractor at no additional cost to the Owner.

3.04 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 32 1726
TACTILE WARNING SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.

B. Related Requirements:

1. Section 32 1313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.05 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering and wear.
b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.02 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Metal Tiles: Accessible truncated-dome detectable warning metal tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

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

a. ADA Solutions, Inc.
b. Advantage Tactile Systems.
c. Detecable Warning Systems, Inc.
d. EJ.
e. Neenah Foundry Company.

2. Material:

a. Stainless-Steel Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

1) Finish and Color:

a) Manufacturer's standard powder coat, color as selected by Architect from manufacturer's full line.
b) Mill finish.

b. Cast Iron: Gray iron, ASTM A 48/A 48M, CL 35.

1) Finish and Color:

a) Manufacturer's standard powder coat, color as selected by Architect from manufacturer's full line.
b) Mill finish.

3. Shapes and Sizes:
   a. Rectangular panel, at least 24 inches deep and no less than 24 inches wide.
   b. Radius panel, nominal 24 inches deep with outside radius indicated on Drawings.
4. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.03 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 32 1313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.04 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION

SECTION 32 33 00
SITE FURNISHINGS (NIC)

FOR REFERENCE ONLY

THIS WORK WAS REMOVED FROM THE PROJECT SCOPE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes outdoor site furniture.

PART 2 PRODUCTS

2.01 BENCHES

A. Eva Bench by Victor Stanley

1. Steel slats.
2. Powder coat finish by manufacturer.
3. Color: Titanium

2.02 TRASH RECEPTACLE

A. SDC-36 by Victor Stanley

1. Solid lid.
2. Side door opening
3. Powder coat finish by manufacturer
4. Color: Titanium

2.03 BIKE RACK

A. BRQS-101, by Victor Stanley

1. Powder coat finish by manufacturer.
2. Color: Titanium

2.04 CIGARETTE ASHTRAY

A. Smoker's outpost outdoor cigarette ashtray, by Park Tables

1. Potable 22 lbs.
2. Aluminum.
3. Color: silver

PART 3 EXECUTION

3.01 INSTALLATION

A. All site furniture shall be surface mounted to the concrete walkways as shown on the Drawings, except for the portable ashtray.

B. Verify location with Owner's Representative prior to mounting hardware.

C. Surface mount per manufacturer's recommendations.

3.02 MAINTENANCE/WARRANTY

A. Provide any product booklets or manufacturer warrantee information to the Owner.

END OF SECTION

SECTION 32 90 00
PLANTING (NIC)

FOR REFERENCE ONLY

THIS WORK WAS REMOVED
FROM THE PROJECT SCOPE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes: plant preparation, plant materials, plant accessories, and maintenance.

1.02 REFERENCE STANDARDS

A. ANSI Z60.1 American Standard for Nursery Stock, most current edition.

B. State of Alaska, Department of Environmental Conservation, concerning applications of herbicides, pesticides, and inspections.

C. Related Requirements:

1. Section 01 70 00 Execution and Closeout
2. Section 31 10 00 Site Clearing
3. Section 32 33 00 Site Furnishings
4. Section 32 92 00 Turf and Grasses

1.03 SUBMITTALS

A. Topsoil Analysis:

1. Furnish soil analysis by a qualified soil-testing facility:
   a. Particle size analysis
   b. Soil pH
   c. Nutrient levels by parts per million including: nitrogen, phosphorus, potassium, magnesium, manganese, and zinc. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.
2. Testing procedures include but are not limited to ASTM WK38106, ASTM D2974 and AASHTO T267.
3. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the Alaska State Division of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

B. Qualification Data: For landscape Installer.

C. Fertilizer, if applicable, application rate and product certificates from manufacturer.

D. Plant list with the common and scientific name of each species. Images of the plants showing containers and the height of plant material with a measuring tape for scale.

E. Images of the rock mulches with measuring tape for scale.

F. Maintenance Schedule.

G. Pesticides and Herbicides: Only if applicable, product label and manufacturer's application instructions specific to Project. See subsection Pesticide Application under Part 3 of this section.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct a meeting at the Unalaska Library project site with Owner’s Representative to review schedules and process prior to beginning work.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. A qualified landscape installer who has worked on an Aleutian Island in Alaska previously on landscaping.
2. Experience: Three years of experience in landscape installation in Alaska.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.
5. Submit explanation of experience to the Owner's Representative for verification, at minimum four weeks prior to application.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil can be material imported to the site, onsite topsoil stockpiled as a part of demolition, or a combination of onsite and imported material meeting the physical and chemical ranges below. Supply Architect with topsoil test reports of proposed material whether it is onsite, imported, or a combined material.

B. Topsoil shall meet the following mix ratios:

1. Organic Material - 15-25 percent by dry weight
2. Silt - 25-45 percent by dry weight
3. Sand - 35-55 percent by dry weight
4. Gravel - Less than two percent

C. The topsoil shall meet the following properties. Fertilizer and limestone applications to supplement topsoil to meet these ranges shall be reviewed with the Owner's Representative prior to application.

1. pH range between 6.5 – 7.5. If topsoil is too acidic review lime amendment applications with Owner's Representative.
2. Nitrogen 30-50 PPM
3. Phosphoric Acid 60-110 PPM
4. Potassium 76-150 PPM

D. The topsoil, whether imported or onsite, shall be free of stones and gravel larger than 1" in any direction, garbage, debris, roots, plants, building products, noxious weeds, invasive plants, toxic chemicals and other artificial products.

2.02 LIME AMENDMENTS

A. Lime amendments if needed based on topsoil pH testing.

B. Limestone shall contain not less than eighty-five percent (85%) of calcium and magnesium carbonates. Agricultural ground limestone suitable for application by a fertilizer spreader shall conform to the following gradation:

1. # 10 - 100% passing by weight
2. # 20 – 90% passing by weight
3. # 100 – 50% passing by weight

2.03 FERTILIZER

A. Standard commercial types in moisture-proof containers. Each container shall be marked with the weight and the manufacturer's guaranteed analysis.

B. No Cyanamid compounds or hydrated lime will be permitted in mixed fertilizers.

C. Application: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.04 **PERENNIALS AND GROUND COVERS**

A. Substitutions: No substitutions will be accepted, except with written permission given by the Owner's Representative 60 days prior to planting.

B. Quality: All plants shall be typical of the species or variety. All plants shall be undamaged, healthy, and free from defects, plant diseases, insect eggs, borers, and all other forms of infection.

C. Delivery: Plants coming from out-of-state certified growers and/or suppliers shall be certified by Federal authorities to be free from disease and infestation. Any inspection certificates required by law to this effect shall accompany each shipment invoiced or order of stock and shall be filed with the Owner's Representative.

D. Inspection: No plant material shall be planted by the Contractor until it is approved by the Owner's Representative prior to planting. All rejected material shall be immediately removed from the site and replaced with approved material at no additional cost to the Owner.

2.05 **LANDSCAPE EDGING**

A. Landscape edging shall be aluminum, one-eighth inch (1/8") thickness by four-inch (4") depth with twelve inch (12") standard aluminum stake. Product example: "Curv-Rite, Inc.," or approved equal by other manufacturers with supporting data from the manufacturer is submitted to the Architect. Comparable products must be architecturally similar in size, type, and grading of materials, dimensions, finishes, and textures. Curv-Rite, Inc. 3603 North Main Street, Wayland, MI 49348

2.06 **LANDSCAPE FABRIC**

A. Landscape fabric shall be UV resistant, black polypropylene polyester blend with a permeability minimum of 12 gals/s.f./min. Landscape fabric shall be DeWitt Pro 5 Weed Barrier (1-800-325-0950) or approved equal.

2.07 **MULCH**

A. Small round landscape rock

1. 2" Diameter, round, dark grey uniform color.
2. Free of fines and debris.

B. Large landscape rock

1. 3"-8" Angular Rock, mixed colors of greys and reds are acceptable.
2. Onsite landscape rock may be salvaged, cleaned, and reused for the large rock mulch.

2.08 **BOULDERS**

A. Boulders

1. Boulders shall meet the ADOT LA Wear quality standards required for riprap. Evenly graded stones that are hard, angular, and have no more than 50% wear at 500

revolutions as determined by AASHTO T96. Use stones with breath and thickness at least ¼ of its length.

2. Large boulders: 4'-6' for the shortest diagonal
3. Medium boulders: 3'-4' for the shortest diagonal
4. Boulder shall be free of flakes, drilling or large cracks.

2.09 **WATER**

A. Water shall be potable.

2.10 **PESTICIDES**

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. The use of pesticides and herbicides shall comply with the section pesticide application described below subsection Pesticide Application under Part 3 of this section.

PART 3 EXECUTION

3.01 **INSPECTION**

A. Examine subgrade areas for debris that will adversely affect the work.

3.02 **UNDERGROUND OBSTRUCTIONS**

A. Request utility locates from local utilities in accordance with state and local statutes.

B. Coordinate with mechanical, electrical, and other trades installing new underground work to determine their exact locations.

C. Should uncharted or incorrectly charted utilities be encountered, notify the Owner's Representative immediately.

3.03 **PROTECTION OF EXISTING TREES**

A. Contractor shall protect existing trees that are not designated for removal on the Drawings. Contractor shall identify a Tree Protection Zone (TPZ) in which activities are restricted around each existing tree that is not designated for removal on the Drawings. The TPZ shall measure as one foot of root area per one-inch Diameter Breast Height (DBH), or the TPZ shall be the tree's canopy drip line, whichever is greater. The TPZ shall be defined with fencing materials that prohibit disturbance, excavation, trenching material storage, including soil, or grade changes.

3.04 **BOULDERS**

A. Large and Medium boulders

1. Owner's Representative to approve boulder locations prior to final install.
2. Burry one-third of the boulder below grade.

3.05 **PLACEMENT OF TOPSOIL**

A. All planting pits shall receive topsoil of depth as indicated on the Drawings.

B. Paved surfaces shall be kept clean during hauling and spreading operations.

C. Remove large clods, stones larger than one inch in any diameter, roots, stumps, and other litter after placement of topsoil.

3.06 **PLANTING**

A. Time of Planting: Planting shall be done when temperatures are above freezing, the ground is frost free, and the soil is in a workable condition.

B. Setting Plants: Each plant shall be planted in planting beds as indicated on the Drawings. All plants shall be set to finished grade ensuring that the base of the plant will not get buried too deep or too high.

C. Backfilling, Planting Pits, and Planting Beds: Backfill in maximum six-inch layers with topsoil. When pit is nearly filled, water thoroughly and allow water to soak away. If settling of the backfill occurs after watering, add more backfill to bring to finish grade.

D. Install landscape fabric in planting beds after topsoil installation, prior to landscape rock.

E. Watering: Thoroughly water each plant immediately following planting.

3.07 PESTICIDE APPLICATION

A. The Contractor shall coordinate with the Architect in the event that disease, invasive plant infestation, or pest problems are observed on plants within a Project area. The Contractor shall formulate an Integrated Pest Management program to control the disease, invasive plants, or pests. The IPM program can use biological, physical, cultural, mechanical, behavioral, and chemical methods to resolve the issue. Chemical pesticides are to be used only when other options are not feasible or effective. If pesticides are used, the least toxic pesticide to accomplish the task shall be used.

1. The Contractor shall apply all materials in complete compliance with all State, Federal, and local regulations, and shall supply the Engineer written proof of their safety and acceptability by State, Federal and Local jurisdictions.

2. The Contractor shall have appropriate permits and certifications as applicable to any pesticide application. Those shall be submitted to the Architect prior to application.

3.08 MAINTENANCE/WARRANTY

A. General

1. Provide a one-year maintenance and guarantee for all plantings beginning at the time of acceptance of the Substantial Completion Inspection. Perform all watering, weeding, pruning, fertilizing, and pest control necessary to maintain the plants and seeding in a healthy condition.

2. A Substantial Completion Inspection shall be conducted upon installation of all plantings. Contractor shall remedy punchlist items after inspection and request approval of outstanding items.

B. Warranty

1. Upon approval of the punch list items from the Substantial Completion Inspection the Substantial Completion Acceptance will be issued, commence a warranty period and provide continuing maintenance.

2. The Owner’s Representative shall have the right to periodically inspect the site during the warranty period.

3. All plants which are found to be dead or in an unhealthy or unsightly condition shall be replaced with new, healthy stock subject to the approval of the Owner’s Representative, at no additional expense to the Owner.

C. Final Acceptance:

1. Request Final Acceptance Inspection in writing to the Owner’s Representative two weeks prior to the one-year anniversary of the Substantial Completion Acceptance.

2. All items must be healthy and appear to be well-maintained.
3. The Owner's Representative will accept items that have been maintained in a satisfactory manner for the specified maintenance/warranty period. Those items that have been planted for over three months of a growing period may be accepted by the Owner's Representative, if displaying healthy growth. The Owner's Representative reserves the right to require one-year maintenance and warranty of plant materials that were installed as replacements.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES (NIC)

FOR REFERENCE ONLY

THIS WORK WAS REMOVED FROM THE PROJECT SCOPE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding and Dry Methods.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

1. Section 01 70 00 Execution and Closeout
2. Section 31 10 00 Site Clearing
3. Section 32 90 00 Planting.

C. State of Alaska, Department of Environmental Conservation, concerning applications of herbicides, pesticides, and inspections.

1.03 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Topsoil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 90 00 Planting for topsoil and drawing designations for topsoil specifications.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before topsoil is placed.

1.04 SUBMITTALS

A. See Section 32 90 00 Planting for general landscaping submittal requirements.

B. Certified seed mixture.

1. Seed shall be certified and shall be furnished in standard containers with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Owner's Representative duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within a 9 month period prior of application. This statement shall include name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished and, in

case of a mixture, the proportions of each kind of seed. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable.

C. For Hydroseeding Applications - Wood Fiber Mulch Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials and application rate.

D. Integrated Pest Management and Pesticides and Herbicides: See section 32 90 00 regarding submittals, products, and applications of an Integrated Pest Management plan and applications of pesticides and herbicides.

E. Maintenance Plan: Plan and schedule for maintenance of turf. Submit before installation.

1.05 **QUALITY ASSURANCE**

A. See Section 32 90 00 Planting for landscape Contractor experience requirements.

B. The turf installer shall:

1. Have experience installing seed in Alaska, on two similar sized projects or larger, using the same application methods proposed in this project.

2. Pesticide Applicator: State licensed, commercial.

1.06 **DELIVERY, STORAGE, AND HANDLING**

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials in accordance with Sections 01 70 00 Execution and Closeout, and 31 10 00 Site Clearing

3. Accompany each delivery of bulk materials with appropriate certificates.

1.07 **FIELD CONDITIONS**

A. Planting shall be done when temperatures are above freezing, the ground is frost free, and the soil is in a workable condition.

B. Unless otherwise specified in writing by the Owner's Representative, planting shall be done between May 15 and August 15, when weather conditions allow.

C. Weather Limitations: Proceed with hydroseeding only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 **SEED**

A. Seed: Clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Mix (Application Rate 3 lbs. per 1,000 square feet):

1. Annual Ryegrass (Lolium multiflorum)

a. Proportion by weight 5%

b. Purity 90%

c. Germination 85%

2. Kenai Kentucky Bluegrass (Poa pratensis 'Kenai')

a. Proportion by weight 30%

b. Purity 90%

c. Germination 85%

3. Alene Kentucky Bluegrass (Poa pratensis)

a. Proportion by weight 25%

b. Purity 90%

c. Germination 85%

4. Boreal Fescue (Festuca rubra 'Broeal')

a. Proportion by weight 40%

b. Purity 90%

c. Germination 85%

2.02 **FERTILIZERS**

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character in the following composition:

1. Application: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.03 **HYDROSEEDING MULCHES**

A. Wood Fiber Mulch

1. The hydroseeding slurry shall contain a dye, per wood fiber mulch manufacturers, to facilitate placement and inspection of the material.

2. A hydraulically-applied, 100% biodegradable Hydraulic Mulch (HM) – Wood composed of 100% recycled long strand, thermally refined (within a pressure vessel) wood fibers that have been pressure treated to 80 – 85 psi (552 – 586 kPa) with steam and heat treated for 15 minutes at 380 – 440 degrees Fahrenheit (193 – 226 degrees Celsius). The HM is phytosanitized, free from plastic netting and forms a bond with the soil surface to create a porous and absorbent erosion layer that enhances germination and plant growth.

a. Will remain in uniform suspension in water under agitation and will blend with grass seed, fertilizer and other additives to form homogeneous slurry.

b. Will form a blotter-like uniform ground cover on application, have moisture absorption, retention and percolation properties, the ability to cover, and hold grass seed in contact with soil, and not create a hard crust upon drying providing a good growth medium.

c. Manufacturer example or approved equal: PROFILE Products LLC, 800-366-1180 (Fax 847-215-0577), www.profileproducts.com

2.04 **PESTICIDES**

A. See Section 32 90 00 Planting.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Examine areas to be planted for compliance with requirements and other conditions
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination in accordance with federal, state and local statues and replace with new planting soil.

3.02 **PREPARATION**

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding overspray.
   2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. See Sections 01 70 00 Execution and Closeout and 31 10 00 Site Clearing for temporary erosion control applications.

C. Place 4-inches of topsoil in areas to be seeded.

D. Smooth the slopes for a uniform appearance and round the top and bottom of the slopes to facilitate tracking or raking. Do not disrupt drainage flow lines.

E. Prepare the topsoil surface by grooving the material in a uniform pattern that is perpendicular to the fall of the slope. Form one-inch wide grooves spaced no more than six inches apart. Use one or more of the following grooving methods with associated equipment before the application of seed:
   1. Manual raking with landscaping rake;
   2. Mechanical track walking with track equipment; or
   3. Mechanical raking with a scarifying slope board.

F. Once topsoil surfaces have been prepared use one of the following methods of seeding application, either hydroseeding or the dry method.

3.03 **HYDROSEEDING**

A. Apply seed and fertilizer in a slurry mix including wood fiber hydroseeding mulch.
   1. Furnish and place a slurry made of seed, fertilizer, water, and hydroseeding mulch material.
   2. Use hydraulic seeding equipment that will maintain a continuous agitation and apply a homogeneous mixture through a spray nozzle. The pump must produce enough pressure to maintain a continuous, nonfluctuating spray that will reach the extremities of the seeding area with the pump unit located on the roadbed. Provide enough hose to reach areas not practical to seed from the nozzle unit situated on the roadbed.

3. Mix the slurry and apply it evenly.
4. Spray-apply slurry uniformly to all areas to be seeded. Apply slurry at a rate in accordance with the manufacturer's recommendations for the mulch and that the seed component is deposited at not less than dry application rate specified.
5. Spray-apply slurry uniformly to all areas to be seeded in a two-step process, spraying from one direction then the opposite to cover all the groves created during soil preparation.

3.04 **DRY METHODS**

A. Use mechanical spreaders, seed drills, landscape seeders, aircraft, cultipacker seeders, fertilizer spreaders, or other approved mechanical spreading equipment. Spread seed not less than 3 lbs. per 1,000 square feet of dry weight.

B. Spread fertilizer separately at the specified rate.

3.05 **TURF MAINTENANCE**

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new seed as required.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering:

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry at recommendation of manufacturer.

3.06 **SATISFACTORY TURF**

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.07 **PESTICIDE APPLICATION**

A. See Section 32 90 00 Planting.

3.08 **CLEANUP AND PROTECTION**

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.09 **MAINTENANCE SERVICE**

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION

SECTION 33 4200
STORMWATER CONVEYANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Catch basins.
4. Drain basins.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Catch basins and Drain Basins: Include plans, elevations, sections, details, frames, covers, and grates.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of pipe and fitting, from manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.

1. Special-Joint Bands: Corrugated steel with O-ring seals.
2. Standard-Joint Bands: Corrugated steel.
3. Coating: Zinc.

2.02 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
1. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
1. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.03 DRAINS

A. Drain Basin:

1. Pre-manufactured product complete with basin and grate.

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

3. Description: Manufactured from PVC pipe stock, using a thermoforming process to fabricate the configuration indicated on the drawings. The drainage pipe stubs shall be fabricated and formed to provide a watertight connections. The joint tightness shall conform to ASTM D3212 and the flexible seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin. The raw materials for the basin body and stub shall conform to ASTM D1784 cell class 12454.
4. Sump: 18” deep.

B. Frame and Grates:
   1. Grate type and size: Dome to match drain basin diameter.
   2. Grate Material: Ductile Iron made specifically for each basin.

2.04 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
   4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
   7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 12-inch total thickness, that match 24-inch-diameter frame and grate.
   8. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
   9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

   1. Size: 24 by 24 inches minimum unless otherwise indicated.
   2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Where connecting to an existing manhole or catch basin, confirm the pipe alignment shown in the plans will allow suitable clearance from other pipes at the connecting structure. If a conflict is discovered, modify new pipe alignment to avoid conflict.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at Install piping with 24-inch minimum cover.
3. Install corrugated steel piping according to ASTM A 798/A 798M.
4. Install PE corrugated sewer piping according to ASTM D 2321.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
2. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 CATCH BASIN INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.05 CONNECTIONS

A. Make connections to existing piping and underground manholes.
1. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform

to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.06 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than a full circle of light is visible when a flashlight is shined through the pipe between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.07 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION

End of Specifications