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IFB NO. Y19-749-RC **ISSUED: March 26, 2019**

INVITATION FOR BIDS

FOR

ORANGE COUNTY FIRE RESCUE FUEL TANK AUTOMATION AND REPLACEMENT

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PART H
TECHNICAL SPECIFICATIONS

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PART H
Volume II

100% Construction Documents
Specifications

Fire Rescue Fuel Tank Automation and Replacement

November 23, 2018

DIVISION 1

01010	SUMMARY OF WORK
01027	APPLICATION FOR PAYMENT
01035	MODIFICATION PROCEDURES
01040	PROJECT COORDINATION
01045	CUTTING AND PATCHING
01200	PROJECT MEETINGS
01300	SUBMITTALS
01380	CONSTRUCTION PHOTOGRAPHS
01400	QUALITY CONTROL SERVICES
01631	PRODUCT SUBSTITUTIONS
01700	PROJECT CLOSE-OUT
01740	WARRANTIES AND BONDS

DIVISION 2
(NOT USED)

DIVISION 3
(NOT USED)

DIVISION 4
(NOT USED)

DIVISION 5
(NOT USED)

DIVISION 6
(NOT USED)

DIVISION 7
(NOT USED)

DIVISION 8
(NOT USED)

DIVISION 9
(NOT USED)

DIVISION 10
(NOT USED)

DIVISION 11
(NOT USED)

DIVISION 12
(NOT USED)

DIVISION 13
(NOT USED)

DIVISION 14
(NOT USED)

DIVISION 15
(NOT USED)

DIVISION 16

16050	BASIC ELECTRICAL MATERIAL AND METHODS
16060	GROUNDING AND BONDING
16072	ELECTRICAL SUPPORTS
16075	ELECTRICAL IDENTIFICATION
16120	CONDUCTORS AND CABLES
16130	RACEWAYS AND BOXES

DIVISION 31

311000	SITE PREPARATION AND EARTHWORK
312000	EXCAVATING, BACKFILLING, AND COMPACTING
313100	SOIL TREATMENT

DIVISION 32

322000	STABILIZED SUBGRADE
323000	ASPHAT PAVING AND RESURFACING
324000	CONCRETE SIDEWALK
324100	CONCRETE FORMWORK
324200	CONCRETE REINFORCEMENT

END OF TABLE OF CONTENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

B. When the titles such as Engineer, Project Engineer, or Owner are used throughout this specification, this implies Orange County as property owner and/or an officially appointed County Representative.

1.2 PROJECT DESCRIPTION

A. Performance of all tasks specified in the contract documents shall be the responsibility of the contractor unless specified otherwise.

1.3 OVERALL SCOPE OF WORK

A. Scope of Work
   1. Contractor shall furnish all of the labor, tools, materials, equipment (to include but not limited to hardware and software), and incidentals necessary to automate, manually operated fuel sites, replace existing equipment with new equipment and the new system, install the software to all data to be accessed via a browser based fuel management system.
   2. All hardware and software connecting to the county network must agree and comply with the County's Enterprise Security Standards.
   3. Contractor shall utilize E.J. Ward as the sole supplier and support agent for all Ward Fuel View Automated Fuel Management System and OMNTEC tank gauging platforms, GEOTAB real-time GPS solutions, and EV chargers provided by Powercharge.
      i. E.J. Ward is the sole supplier and support agent for its products, systems and solutions, either direct or through Evans Plumbing Inc (DBA as EPI Construction INC) 23808 SW 30th Ave, Newberry Fl, 34222.
      ii. Only Ward supplied devices are certified to operate simultaneously with the Ward AFMS and CANceiver while simultaneously plugged into the vehicles OBDII port.

B. Hardware Requirements
   1. The Fuel Control Terminal (FCT) shall be a stand-alone unit comprising of a power coated aluminum or stainless-steel exterior and all required peripherals including the single board computer (SBC) with an IoT Core Windows 10 operating system or Embedded Debian Linux, color display panel, pump control module, HID/Proximity card reader, magnetic stripe card reader and communication modules shall be standard.

a) Operating temperature range shall be -40C to +85C and meet local, state, and national codes including the UL 1238 standard
b) The fuel control terminal shall control up to ten (10) mechanical hoses in one terminal. Hose control modules shall be available in individual five (5) hose configurations.
c) The site controller shall store up to 1,000,000 transactions and 500,000 vehicles/devices with the ability to set limitations and restrictions on each.
d) The industrial rated single board computer shall be designed to survive the harsh fueling depot environment.
e) The fuel control terminal shall come standard with a real-time clock, along with surge suppressors for transient and noise immunity.
f) The system shall include a power fail recovery mechanism.
g) The fuel control terminal shall be flexible with all types of communication including TCP/IP, Cellular, 802.11 wireless, and satellite communications systems approved for use by Orange County ISS

3. Vehicle telematic devices shall be a single OBDII plugin for light duty, heavy duty and hybrid electric vehicles to capture but not limited to J1708, J1850, J1939, J1962, J1978, J2284 and other common SAE protocols. I/O capacity 8 digital/1 analog. Operating temperature -40C to +85C. Communication shall be encrypted wireless 802.11 to the network and when used in an automated environment. Device shall be reprogrammable wirelessly and include a method to do a factory reset when moved from vehicle to vehicle. Device shall be capable of capturing GPS location data in a passive configuration with the installation of a compatible antenna.

C. Software Requirements
1. Enterprise Class .Net scalable Web-based application that provides complete access, reporting and control of fuel and fleet assets in an easy to use software platform. Data and reports should be accessible through a web browser. MS SQL 2012 or newer compatible or optionally Oracle version 11 or newer.
2. All communications between the fuel control terminal and the host server are to be encrypted via Secured Socket Layer (TLS) protocol with the transport protocol being HTTPS.
3. Two Factor Authentication via an Encrypted Token based security mechanism provided by a communications API shall include:
    a. Request Token authentication using SSL encryption, for all requests.
    b. IP Port Address verification of incoming requests to prevent IP hijacking
    c. User ID verification on all incoming requests to ensure user has proper credentials to system
    d. Enforces token expiration to prevent tokens from being gathered and stored for later usage.
    e. Ensures API services are not executed by unauthorized sources
    f. External API Key token verification on all incoming requests
4. Passwords storage shall be encrypted. Passwords must have a default complexity of at least eight characters, one number, and one capital letter. Passwords shall expire after a configurable number of days. The system shall support LDAP authentication allowing users to use their existing passwords to access the system.

D. General Requirements

1. The Successful Offeror shall have a minimum of ten (10) years' experience in the design and manufacture of fuel management/advanced vehicle location systems.

2. The system shall be able to accommodate future expansions in the number of fuel sites, vehicles, drivers, dispensers, and nozzles.

3. The system shall be capable of monitoring 400 vehicles, 150 portable tanks, 2000 employees.

4. The system shall be optionally capable of passive and active GPS monitoring of fleet vehicles.

5. The system shall seamlessly integrate with our current Square Riggerfleet management software.

6. Fuel sites that currently dispense diesel fuel may be expanded in the future to include the dispensing of diesel exhaust fluid (DEF). The Fuel Management system shall accommodate the tracking and dispensing of DEF.

7. The system shall allow automated and manual fueling.

8. In the fully automated mode, all control, authorization, and accounting operations shall be conducted automatically by the system with the operator required to swipe employee identification and enter employee PIN

9. The automated fueling procedure shall be as follows:

    a. The System shall automatically identify the vehicle when the fuel nozzle is inserted into the vehicle's fuel inlet.

    b. The System shall turn on the corresponding fuel dispenser only if the vehicle and operator are authorized for fueling as determined by the programed business rules set of conditions. Operator confirmation will have a dual step authorization, ID proximity card and employee PIN.

    c. The System shall automatically suspend fueling if the nozzle is removed from the vehicle fuel inlet or no pulses are detected from the fueling pump. The System shall append to the same transaction if the nozzle is re-inserted in the same vehicle within a specified period of time. The transaction shall be terminated if the specific period of time elapses or if the dispenser is turned off.

    d. The System shall also have the capability to track and capture OBDII generated vehicle data, such as odometer, idle time, speeding, braking, distance, PTO, engine hour timers, engine temperature, fuel consumption and seatbelt utilization.

e. In manual fueling, a magnetic stripe card, HID style proximity badge and a keypad shall be available as alternative method for initiating a fueling transaction.

f. A two-stage authorization process shall be provided by identifying both the vehicle and the driver prior to refueling. Both driver and vehicles IDs shall be stored in the transaction. The two-stage authorization process shall be flexible enough to link the vehicle or asset to a specific driver or fueler.

10. In the automated mode, the OBDII telematic device installed in the vehicle shall be used for automated fuel authorization.

11. The fuel control terminal shall come standard with a wireless interface to communicate to all devices including the wireless hose nozzle module and vehicle tags.

12. The wireless hose module nozzle mounted reader shall be a self-contained unit installed on the nozzle. No wires shall be connected to the wireless nozzle mounted reader.

13. The wireless nozzle reader must be designed for most common nozzle types. The reader shall fit onto existing fueling nozzles and cradles of most common dispensers.

14. Upon insertion of the nozzle into the vehicle fuel inlet, the wireless hose module shall communicate with the passive tag, retrieve data for fuel authorization, the system must work with hoses up to 100 feet in length.

15. Refueling shall take place regardless of the connectivity to the host computer. Refueling limits and restrictions shall be downloaded from the host computer to all fuel control terminals enabling offline refueling with limits and restrictions when communication is not available.

16. The fuel control terminal shall authenticate the data retrieved from the vehicle and check it against the existing set of limits and restrictions.

17. If all conditions are met, the fuel control terminal shall authorize immediate refueling.

18. Vehicles not installed with passive OBDII telematics shall have the ability to use manual authorizing devices including magnetic cards, keypad entry, HID badges or Key Fob.

19. The system shall monitor and control fuel dispensers including the ability to remotely start a pump, dispense fuel from a specific hose and limit the quantity to a specific transaction.

20. The system shall interface with all Tank Level Systems (TLS) including but not limited to Omntec, and Veeder Root.

21. The system shall provide odometer reasonability checks.

22. System shall have the option to approve or decline refueling according to pre-defined limits and restrictions for the specific unit.
    Such limitations shall include:
    a. Limit of daily, weekly, and monthly refueling volume amount
    b. Enable or disable vehicle refueling on specific days (weekdays for example)
    c. Limit the maximum refueling sessions for a specific vehicle per day, week, or month
    d. Block specific stations for a specific vehicle (if vehicle is restricted for operation in a specific zone)
    e. Restriction of specific fuel types for refueling of a specific vehicle
    f. Availability to identify and control fuel issued to gas cans.

E. Tank Level Monitoring
    1. Tank level monitoring system must be capable of full integration with EJ Ward system. Communication of system must meet EJ Ward and OCFRD ISS requirements and approvals. Communication may use same data transferring system as EJ Ward or provide own.

F. Reporting
    1. System must allow for report generation with customization.
        a. Reportable Data [but not limited to]
            i. Vehicle ID
            ii. Vehicle odometer readings
            iii. Vehicle consumption
            iv. Vehicle statistics (MPG / Hours per gallon)
            v. Employee ID
            vi. Fuel container
            vii. Fuel container consumption
            viii. Station tank consumption
            ix. Station tank inventory levels
        b. Report capable of cross referencing of all reportable data

G. System Access
    1. Software system must allow controlled user access and capabilities.
        a. User Level Access [but not limited to]

            i. Administrator
                1. Capable of addition
                    a. Vehicles
                    b. Tanks
                    c. Users and level assignments
                2. Programming vehicle tags
                    a. Exchanging vehicle tags and connections
                3. Ability to override or change limitations
                4. Full report generation capabilities

            ii. Managerial level

1. Review all portions of system
2. Review all county wide sub systems
3. Limited override or changing of set limits
4. Full report generation capabilities

iii. Supervisory level
1. Limited review selected subsystems
2. Limited report generation

iv. End User
1. Dispensing capabilities only

H. Current Equipment Needs
1. Vehicle ID tags = 350
2. Portable Tank tags = 100
3. Magnetic cards = 200
4. OBD connections = 350, Includes all light, medium and heavy rolling stock
5. Programmer for tags, magnetic cards and OBD = 2

I. Training Needs
1. Vendor shall provide training to all users. Below is a list of users required training [but not limited to]
a. Administrator, Managerial, and Supervisory Users
i. Report generation
ii. System access
iii. Editing capabilities
iv. Use of terminals
v. Fueling Process
b. End Users (may be performed via video recording)
i. Use of terminals
ii. Fueling Process
c. Fleet Technicians
i. Installation of tags and OBD devices
ii. Use of terminals
iii. Fueling Process

1.4 SCOPE BY SITE

A. Base Bid: 10 Stations.

1. Project Identification: **Orange County Fire Station 33.**

1. Project Location: 1700 S Apopka Vineland Rd, Orlando, FL32835.

2. Project Scope:

a. Create branch feed of 120V from existing panel in existing conduit to power fuel control terminal (FCT).
b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
c. Provide and install new 12VCD pulser board.
d. Provide new concrete pad.
e. Install FCT unit.

f. Connect and configure pulser board to fire rescue network via FCT.
g. Configure communication with FCT to communicate with fire rescue server.
h. Provide and configure fuel management software.
i. Provide and install hose module on each dispenser nozzle.
j. Provide and install fuel tags on all applicable vehicles.
k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

2. Project Identification: **Orange County Fire Station 34.**
    1. Project Location: 4000 Winter Garden Vineland Rd Winter Garden, FL 34787.
    2. Project Scope:
        a. Create branch feed of 120V from existing panel in existing conduit to power fuel control terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

3. Project Identification: **Orange County Fire Station 40.**
    1. Project Location: 5570 Beggs Rd Orlando, FL 32810.
    2. Project Scope:
        a. Create branch feed of 120V from existing panel in existing conduit to power fuel control terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.

h. Provide and configure fuel management software.
i. Provide and install hose module on each dispenser nozzle.
j. Provide and install fuel tags on all applicable vehicles.
k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

4. Project Identification: **Orange County Fire Station 51.**
    1. Project Location: 1700 W Oakridge Rd Orlando, FL 32809.
    2. Project Scope:
        a. Create branch feed of 120V from existing panel in existing conduit to power fuel control terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

5. Project Identification: **Orange County Fire Station 56.**
    1. Project Location: 13303 International Dr Orlando, FL 32821.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.

j. Provide and install fuel tags on all applicable vehicles.
k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

6. Project Identification: **Orange County Fire Station 58.**

1. Project Location: 2900 Deerfield Blvd Orlando, FL 32821.

2. Project Scope:

a. Create branch feed of 120VAC from existing panel in new conduit to power Fuel Control Terminal (FCT).
b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
c. Provide and install new 12VCD pulser board.
d. Provide new concrete pad.
e. Install FCT unit.
f. Connect and configure pulser board to fire rescue network via FCT.
g. Configure communication with FCT to communicate with fire rescue server.
h. Provide and configure fuel management software.
i. Provide and install hose module on each dispenser nozzle.
j. Provide and install fuel tags on all applicable vehicles.
k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

7. Project Identification: **Orange County Fire Station 70.**

1. Project Location: 1027 E Wallace St, Orlando, FL 32809.

2. Project Scope:

a. Create branch feed of 120VAC from existing panel in new conduit to power Fuel Control Terminal (FCT).
b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
c. Provide and install new 12VCD pulser board.
d. Provide new concrete pad.
e. Install FCT unit.
f. Connect and configure pulser board to fire rescue network via FCT.
g. Configure communication with FCT to communicate with fire rescue server.
h. Provide and configure fuel management software.
i. Provide and install hose module on each dispenser nozzle.
j. Provide and install fuel tags on all applicable vehicles.

k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

8. Project Identification: **Orange County Fire Station 80.**

    1. Project Location: 1841 Bonneville Dr, Orlando, FL 32826.

    2. Project Scope:

        a. Create branch feed of 120VAC from existing panel in new conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

9. Project Identification: **Orange County Fire Station 81.**

    1. Project Location: 901 S. Econlockhatchee Trail, Orlando, FL 32825.

    2. Project Scope:

        a. Create branch feed of 120VAC from existing panel in existing conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.

l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

10. Project Identification: **Orange County Fire Station 83.**

3. Project Location: 11950 E Lake Underhill Rd, Orlando, Fl, 32825.

4. Project Scope:

a. Create branch feed of 120VAC from existing panel in existing conduit to power Fuel Control Terminal (FCT).
b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
c. Provide and install new 12VCD pulser board.
d. Provide new concrete pad.
e. Install FCT unit.
f. Connect and configure pulser board to fire rescue network via FCT.
g. Configure communication with FCT to communicate with fire rescue server.
h. Provide and configure fuel management software.
i. Provide and install hose module on each dispenser nozzle.
j. Provide and install fuel tags on all applicable vehicles.
k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
l. Provide and install tank level monitor.
m. Connect and configure fuel tank monitor to fire rescue network via FCT.

B. Add Alternate 1: 5 Stations

1. Project Identification: **Orange County Fire Station 27.**

1. Project Location: 2248 Novella Eliza Ln, Apopka, FL 32712.

2. Project Scope:

a. Create branch feed of 120VAC from existing panel in new conduit to power Fuel Control Terminal (FCT).
b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
c. Provide and install new 12VCD pulser board.
d. Provide new concrete pad.
e. Install FCT unit.
f. Connect and configure pulser board to fire rescue network via FCT.
g. Configure communication with FCT to communicate with fire rescue server.
h. Provide and configure fuel management software.
i. Install concrete pad for FCT.
j. Provide and install hose module on each dispenser nozzle.
k. Provide and install fuel tags on all applicable vehicles.
l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
m. Provide and install tank level monitor.
n. Connect and configure fuel tank monitor to fire rescue network via FCT.

2. Project Identification: **Orange County Fire Station 43.**
    1. Project Location: 2700 N Apopka Vineland Rd, Oakland, Fl, 34786.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

3. Project Identification: **Orange County Fire Station 52.**
    1. Project Location: 4765 W Sand Lake Rd, Orlando, FL 32819.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Install FCT unit.
        e. Connect and configure pulser board to fire rescue network via FCT.
        f. Configure communication with FCT to communicate with fire rescue server.
        g. Provide and configure fuel management software.
        h. Install concrete pad for FCT.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

4. Project Identification: **Orange County Fire Station 77.**
    1. Project Location: 11501 Moss Park Rd, Orlando, FL, 32824.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

5. Project Identification: **Orange County Fire Station 84.**
    1. Project Location: 1221 N Fort Christmas Rd, Christmas, Fl, 32709.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

C. Add Alternate 2: 5 stations

1. Project Identification: **Orange County Fire Station 31.**

    1. Project Location: 6116 Apopka Vineland Rd, Orlando, FL 32805.

    2. Project Scope:

        a. Create branch feed of 120VAC from existing panel in new underground to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

2. Project Identification: **Orange County Fire Station 35.**

    1. Project Location: 7435 Winter Garden Vineland Rd, Windermere, Fl, 34786.

    2. Project Scope:

        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

3. Project Identification: **Orange County Fire Station 37.**
    1. Project Location: 540 E Oakland Ave, Oakland, FL 34787.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in existing underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

4. Project Identification: **Orange County Fire Station 65.**
    1. Project Location: 4999 N Orion Blvd, Orlando, FL 32876.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

5. Project Identification: **Orange County Fire Station 86.**
    1. Project Location: 3202 Babbitt Ave, Orlando, FL 32833.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Install concrete pad for FCT.
        j. Provide and install hose module on each dispenser nozzle.
        k. Provide and install fuel tags on all applicable vehicles.
        l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        m. Provide and install tank level monitor.
        n. Connect and configure fuel tank monitor to fire rescue network via FCT.

D. Add Alternate 3: 5 Stations
    1. Project Identification: **Orange County Fire Station 20.**
        1. Project Location: 3200 Washington St Zellwood, FL 32798.
        2. Project Scope:
            a. Create branch feed of 120VAC from existing panel in existing underground conduit to power Fuel Control Terminal (FCT).
            b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
            c. Provide and install new 12VCD pulser board.
            d. Provide new concrete pad.
            e. Install FCT unit.
            f. Connect and configure pulser board to fire rescue network via FCT.
            g. Configure communication with FCT to communicate with fire rescue server.
            h. Provide and configure fuel management software.
            i. Install concrete pad for FCT.
            j. Provide and install hose module on each dispenser nozzle.
            k. Provide and install fuel tags on all applicable vehicles.
            l. Connect and configure hose module and fuel tags to fire rescue network via FCT.
            m. Provide and install tank level monitor.
            n. Connect and configure fuel tank monitor to fire rescue network via FCT.

2. Project Identification: **Orange County Fire Station 55.**
    1. Project Location: 801 Greenway Professional CT Orlando, FL 32824.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in existing underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

3. Project Identification: **Orange County Fire Station 63.**
    1. Project Location: 2450 N Goldenrod Rd Winter Park, FL 32807.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

4. Project Identification: **Orange County Fire Station 66.**
    1. Project Location: 996 N Semoran Blvd, Orlando, FL 32807.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

5. Project Identification: **Orange County Fire Station 85.**
    1. Project Location: 13801 Townsend Dr, Orlando, FL 32828.
    2. Project Scope:
        a. Create branch feed of 120VAC from existing panel in new underground conduit to power Fuel Control Terminal (FCT).
        b. Provide and install seal-offs and conduit terminations in FCT base as per local NEC code.
        c. Provide and install new 12VCD pulser board.
        d. Provide new concrete pad.
        e. Install FCT unit.
        f. Connect and configure pulser board to fire rescue network via FCT.
        g. Configure communication with FCT to communicate with fire rescue server.
        h. Provide and configure fuel management software.
        i. Provide and install hose module on each dispenser nozzle.
        j. Provide and install fuel tags on all applicable vehicles.
        k. Connect and configure hose module and fuel tags to fire rescue network via FCT.
        l. Provide and install tank level monitor.
        m. Connect and configure fuel tank monitor to fire rescue network via FCT.

1.4 CONTRACTOR RESPONSIBILITIES

A. General:

1. The contractor shall have all submittals approved by the Engineer and accepted by the Owner prior to the start of active construction.

2. The contractor shall have all equipment and material onsite prior to the start of active construction.

3. The contractor shall submit to the Owner prior to the project pre-construction meeting the following:

   a. Schedule of Values
   b. Construction Schedule
   c. Submittal Schedule
   d. Emergency Telephone List including subcontractors and suppliers

4. The contractor shall field verify existing conditions of construction prior to start of active construction.

5. The contractor shall coordinate with the Owner on the operation of the existing fire alarm system prior to the start of active construction. There shall be an action plan for the operation of the fire alarm system during construction submitted by the contractor to the Owner for acceptance. This action plan shall be in place prior to the start of active construction. Any false fire alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all costs incurred from the local fire department for responding to a false alarm.

6. The contractor is responsible for moving furniture and or equipment if necessary to perform the work included in the contract. The contractor is responsible for placing the furniture and or equipment back in its original location.
The contractor is responsible for any damages to furniture, equipment, etc., which occur during construction. The contractor shall provide protection for floors, walls, furniture, equipment and any other items that may be subject to damage during the construction periods.

7. The contractor shall coordinate with the Owner on the operation of the security alarm system prior to the start of active construction. The contractor shall submit an action plan for operation of the security alarm system during construction to the Owner for acceptance prior to start of active construction. This active plan shall be in place prior to the start of active construction. Any false security alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all cost incurred from the local police and or sheriff department for responding to a false alarm.

8. The contractor shall videotape or take pictures of pre-existing conditions of the interior and exterior of the building prior to the start of active construction. Failure to provide photographs or videotape prior to start of construction, places the responsibility on the Contractor to complete the necessary replacement, repairs,

and or cleaning as determined by the Owner at no additional cost to the Owner. One set of photographs (in a three-ring binder) or videotape of the site existing conditions shall be submitted to the Owner.

9. The contractor shall at all times maintain daily cleanup of construction areas. Work areas that are not cleaned by the contractor, and cleaned by the Owner, those costs shall be charged back to the contractor via change order.

10. The contractor shall provide a construction schedule to the Owner's Project Manager prior to the pre-construction meeting. The contractor shall update the construction schedule weekly and submit it to the Owner's Project Manager for review.

11. The contractor shall provide verification of similar projects completed over previous five years.

1.5 WORK UNDER OTHER CONTRACTS

A. Separate contracts may be issued to perform certain construction operations at the site.

1.6 WORK SEQUENCE

A. Normal business hours are defined as 8:00am to 5:00pm Monday through Friday. Material and equipment deliveries will be during normal business hours. After hours is defined as 5:01pm to 7:59am Monday through Friday. After hours work shall not be an additional cost to the Owner.

B. The Contractor may work on the weekend at his or her discretion. Weekend work shall not be an additional cost to the Owner. The Contractor shall coordinate with the Owner for access to the building on weekends and after hours work.

1.7 CONTRACTOR USE OF PREMISES

A. General: During the construction period, the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.

B. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may use any portion of the site for storage or work areas or any legal purpose.

1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owners' employees at all times. Do not use these areas

for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

3. Burial of Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning.

4. Where appropriate, maintain the existing building in a watertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and it's occupants during the construction period.

5. Confine construction operations to the areas permitted by the contract documents and other Owner directives.

6. Provide protection and safekeeping of material and equipment stored on premises.

7. Contractor will move any stored material and equipment, which interfere with operations of the Owner or other contractors.

8. Comply with Owners' requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements and pollution control requirements.

9. Contractor to require all employees and subcontractors to wear non-objectionable clothing; prohibit revealing clothing and articles of clothing with offensive writings displayed. The contractor shall require offending personnel to leave the premises until such clothing is changed.

10. Contractor employees and subcontractors will not fraternize with County employees or the general public during the entire construction period.

11. Use of sound equipment (such as boom boxes, stereos, radios, etc.) during day times of construction is not allowed.

12. Smoking is not allowed on County property.

13. Conduct that is disrespectful, abusive or otherwise objectionable to the Owners' employees or general public will not be allowed at any time during the construction period. Repetitive complaints and violations of the requirements listed above will be cause for dismissal and or permanent removal of offending personnel from the project.

14. Contractor to coordinate with the Owner the site location for storage of equipment, machinery, materials, tools and a construction waste dumpster.

15. Contractor shall at all times keep the premises free of all waste or surplus materials, rubbish and debris, which is caused by contractor employees or subcontractors resulting from their work. Contractor shall maintain a safe work environment to all building occupants during the construction period.

1.8 OWNER OCCUPANCY

A. Owner Occupancy: The Owner will be occupying the building during construction. Nor mal occupancy hours are 7 AM to 5 PM Monday through Friday. The contractor is to coordinate with the Owner's representative for areas in the building that work can be performed on during normal business hours. Work performed after normal business hours can be done provided the area where work is done is fully operational and back in original condition prior to beginning of the next business day. Such placing of equipment and partial occupancy shall not constitute acceptance of the total work.

1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.

2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.9 DISTRIBUTION OF RELATED DOCUMENTS

A. The Contractor is solely responsible for the distribution of ALL related documents/drawings to ALL appropriate vendors/subcontractors to ensure proper coordination of all aspects of the project and its related parts during bidding and construction.

1.10 CONTRACT DOCUMENT FILE

A. Copies of the Contract Documents, Plans, Specifications, Addenda, Change Orders, Engineers Supplemental Instructions, approved Shop Drawings, Substitution Acceptances, etc. shall be placed and maintained at the project site by the Contractor throughout the entire contract period. These said documents shall be filed in a manner that allows for ease of retrieval. Documents shall be made available to the Engineer and the County's representatives throughout this same period.

1.11 BUILDING/SITE SECURITY

A. The building shall be secured from unwarranted entry at the end of each workday.

PART 2 - PRODUCTS

2.1 ASBESTOS FREE MATERIAL

A. Contractor shall provide a written and notarized statement on company letterhead(s) to certify and warrant that ONLY ASBESTOS FREE MATERIALS AND PRODUCTS were provided as required by the Engineer in Section 01400, QUALITY CONTROL. Such statement shall be submitted with the final payment request. Final payment shall not be made until such statement is submitted. Contractor agrees that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction, the Contractor shall be liable for all costs related to the redesign or modification of the construction of the project so that materials containing asbestos are removed from the facility. If construction has begun or has been completed pursuant to a design that includes asbestos containing materials, the Contractor shall also be liable for all costs related to the abatement of such abestos.

PART 3 EXECUTION (Not applicable).

END OF SECTION 01010

SECTION 01027 – APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01300 – "SUBMITTALS".

1.3 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting.
   2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
   1. Identification: Include the following project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of the Engineer
      c. Project Number
      d. Contractor's name and address
      e. Date of submittal
   2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
      a. Generic name
      b. Related Specification Section
      c. Change Orders (numbers) that have affected value
      d. Dollar Value
      e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
   a. A value will be given for at least every major specification section (subsections can logically be grouped together).
   b. A single material subcontractor will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
   c. All multiple item subcontracts or work items (i.e. mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
   d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 5% of contract price.
   e. For multi-story work all items broken down per floor.
   f. HVAC: Typically shown per specification section, labor and material, per floor.
   g. Electrical: same as HVAC.
   h. Logical grouping of specification subsections are permitted.
4. Round amounts off the nearest whole dollar, the total shall equal the Contract Sum.
5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

   a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the contract sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner's representative and paid for by the Owner.
   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.

B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form given at the Preconstruction Conference.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
   1. Entries shall match data on the Schedule of Values and Contractor Construction Schedule. Use updated schedules if revisions have been made.
   2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit four (4) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
   1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.

F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors of sub-subcontractors and suppliers for the construction period covered by the previous application.
   1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. The Owner reserves the right to designate which entities involved in the work must submit waivers.
   4. List all Subcontractor's start and finish dates to substantiate any Notice to Owner received by the Project Manager.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
   1. List of principal subcontractors
   2. List of principal suppliers and fabricators
   3. Schedule of Values
   4. Approved Contractor's Construction Schedule (preliminary if not final)
   5. Schedule of principal products
   6. Schedule of unit prices (if applicable)
   7. Submittal schedule (preliminary if not final)
   8. List of Contractor's staff assignments
   9. List of Contractor's principal consultants
   10. Copies of building permits for trades requiring separate permits
   11. Copies of authorizations and licenses from governing authorities for performance of the Work
   12. Initial progress report
   13. Report of Pre-construction Meeting
   14. Initial settlement survey and damage report, (if required)

15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings

H. Interim Application for Payment: Payment will be processed once a month. No applications will be processed without receipt of previous months waiver of lien described in subsection F above. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (10%) will be held for all interim applications.

I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Application shall also include all items listed in Part H. above.

J. Administrative actions and submittals that shall proceed or coincide with Substantial Completion Payment. Substantial Completion as defined per General Conditions Section “F” application include:
1. Occupancy permits and similar approvals
2. Warranties (guarantees) and maintenance agreements
3. Test/adjust/balance records
4. Maintenance instructions
5. Start-up performance reports
6. Change-over information related to Owner’s occupancy, use, operation and maintenance
7. Final cleaning
8. Application for reduction of retainage, and consent of surety
9. List of incomplete Work, recognized as exceptions to Project Manager’s Certificate of Substantial Completion

K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment. Application for Payment includes the following:
1. Completion of Project Close-Out requirements
2. Completion of items specified for completion after Substantial Completion
3. Assurance that unsettled claims will be settled
4. Assurance that all work has been completed and accepted
5. Proof that taxes, fees and similar obligations have been paid
6. Removal of temporary facilities and services
7. Removal of surplus materials, rubbish and similar elements
8. Change of door locks to Owner’s access
9. Submission of all close-out documents. Refer to Section 01700.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035 - MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 1 Section 01300 Submittals for requirements for the Contractor’s Construction Schedule.
   2. Division 1 Section 01027 Application for Payment for administrative procedures governing applications for payment.
   3. Division 1 Section 01631 Product Substitutions for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

A. Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Project Manager.

1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
   1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.
   2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.
      a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.
1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section 01631 “Product Substitutions” - if the proposed change in the work requires that substitution of one product or system for a product or system not specified.
5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.

C. Proposal Request Form: Project Manager will transfer the information to the appropriate forms for approval. Use AIA Document G 709 for Change Order Proposal Requests.

D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Project Manager will issue a Change Order for signatures of the Owner and Contractor on County's Change Order form, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15113

SECTION 01040 - PROJECT COORDINATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for project coordination including, but not necessarily limited to:

1. Coordination
2. Administrative and supervisory personnel
3. General installation provisions
4. Cleaning and protection

B. Progress meetings, coordination meetings and Pre-installation conferences are included in Section 01200 “Project Meetings”.

C. Requirements for the Contractor’s Construction Schedule are included in Section 01300 “Submittals”.

1.3 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specification that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required: notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Schedules
2. Installation and removal of temporary facilities
3. Delivery and processing of submittals
4. Progress meetings
5. Project close-out activities

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.

E. Lack of coordination as specified in this and other sections of the contract documents are in grounds for assessment of back charges and/or termination in order to remediate the situation.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the interrelationship of components shown on separate Shop Drawings.

2. Indicate required installation sequences.

3. Comply with requirements contained in Section “Submittals”.

4. Refer to Division-15 Section “Basic Mechanical Requirements,” and Division-16 Section “Basic Electrical Requirements” for specific coordination Drawing requirements for mechanical and electrical installations.

B. Staff Names: At the Preconstruction Conference submit a list of the Contractor’s principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Project Manager for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to ensure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where the applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading
2. Excessively high or low temperatures
3. Excessively high or low humidity
4. Air contamination or pollution
5. Water
6. Solvents
7. Chemicals
8. Soiling, staining and corrosion
9. Rodent and insect infestation
10. Combustion
11. Destructive testing
12. Misalignment
13. Excessive weathering
14. Unprotected storage
15. Improper shipping or handling
16. Theft
17. Vandalism

END OF SECTION 01040

SECTION 01045 - CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building’s appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform Work.

4. Indicate dates when cutting and patching is to be performed.

5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

7. Approval by the Engineer to proceed with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.

   1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.

      a. Foundation construction
      b. Bearing and retaining walls
      c. Structural concrete
      d. Structural steel e. Lintels
      f. Timber and primary wood framing
      g. Structural decking
      h. Miscellaneous structural metals
      I. Stair systems
      j. Exterior curtain wall construction k. Equipment supports
      l. Piping, ductwork, vessels and equipment

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

   1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.

      a. Shoring, bracing and sheeting
      b. Primary operational systems and equipment
      c. Air or smoke barriers
      d. Water, moisture, or vapor barriers
      e. Membranes and flashings
      f. Fire protection systems
      g. Noise and vibration control elements and systems
      h. Control systems
      I. Communication systems
      j. Conveying systems
      k. Electrical wiring systems

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

a. Processed concrete finishes
b. Preformed metal panels
c. Window wall system
d. Stucco and ornamental plaster e.Acoustical ceilings
f. Carpeting
g. Wall covering
h. HVAC enclosures, cabinets or covers
I. Roofing systems

PART 2 PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Engineer/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with all parties involved in cutting and patchng, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.

4. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.

    a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after patched area has received primer and second coat.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged materials to their original condition.

END OF SECTION 01045

SECTION 01200 - PROJECT MEETINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference
2. Pre-Installation Conference
3. Coordination Meetings
4. Progress Meetings

B. Construction schedules are specified in Section 01300 Submittals.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attends: The County's Representative, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Tentative construction schedule
2. Critical Work sequencing and/coordinating
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment
6. Distribution of Contract Documents
7. Submittal of Shop Drawings, Product Data and Samples
8. Preparation of record documents
9. Use of the Premises
10. Office, Work and storage areas
11. Equipment deliveries and priorities
12. Safety procedures

13. First aid
14. Security
15. Housekeeping
16. Working hours

D. Contractor must submit at the time of the meeting at least the following items:

1. Schedule of Values
2. Listing of key personnel including project superintendent and subcontractors with their addresses, telephone numbers, and emergency telephone numbers.
3. Preliminary Construction Schedule
4. Submittal Schedule

1.4 PRE-INSTALLATION CONFERENCE

A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

a. Contract Documents
b. Options
c. Related Change Orders
d. Purchases
e. Deliveries
f. Shop Drawings, Product Data and Quality Control Samples
g. Possible conflicts
h. Compatibility problems
I. Time schedules
j. Weather limitations
k. Manufacturer's recommendations
l. Comparability of materials
m. Acceptability of substrates
n. Temporary facilities
o. Space and access limitations
p. Governing regulations
q. Safety
r. Inspection and testing requirements
s. Required performance results
t. Recording requirements
u. Protection

2. Record significant discussions and agreements and disagreements of each conference along with and approved schedule. Distribute the record of the meeting to everyone concerned promptly including the Owner and Engineer.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 COORDINATION MEETINGS

A. Conduct project coordination meeting at weekly intervals on day and time as established by the Project Manager or more frequently, if necessary convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved, to include subcontractors and representatives.

C. Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at bimonthly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress of involved in planning, coordination or performance of future activities with the project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor’s Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor’s Construction Schedule, whether on time, ahead, or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including such items as:

a. Interface requirements
b. Time
c. Sequences
d. Deliveries
e. Off-site fabrication problems
f. Access
g. Site utilization
h. Temporary facilities and services
I. Hours of work
j. Hazards and risks
k. Housekeeping
l. Quality and work standards
m. Change Orders
n. Documentation of information for payment requests.

A. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, or progress since the previous meeting and report.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01300 - SUBMITTALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

1. Contractor's Construction Schedule
2. Submittal Schedule
3. Daily Construction Reports
4. Shop Drawings
5. Product Data
6. Samples

B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Permits
2. Applications for Payment
3. Performance and Payment Bonds
4. Insurance Certificates
5. List of Subcontractors with start and finish dates (update as necessary)
6. Schedule of Values
7. Construction Schedule

C. The Schedule of Values submittal is included in Section 01027 "Applications for Payment".

1.3 ELECTRONIC SUBMITTAL PROCEDURES

A. General: Submittals shall be submitted electronically directly to the Engineer from the General/Mechanical/Electrical Contractor.

1. All shop drawings and other submittals as specified herein, shall be submitted in electronic format. All electronic CAD generated drawings shall be in Acrobat PDF format and all product data or other information shall be submitted in Acrobat PDF format. Coordinate with Engineer prior to submitting. All electronic submittals shall

be posted to the Engineer's FTP site. Information regarding the username and password shall be distributed to all parties prior to the pre-construction meeting.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2.. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
b. If an intermediate submittal is necessary, process the same as the initial submittal.
c. Allow two weeks for reprocessing each submittal.
d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

C. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches on label or beside title block to record contractor's review and approval markings and action taken by Engineer.

3. Include the following information on label for processing and recording action taken:

a. Project name.

b. Date.
c. Name and address of Engineer.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

2) Where multiple products are shown, highlight/circle or identify product intended to be used

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

D. Contractor shall be responsible for cost of re-review of rejected submittals, shop drawing, etc. Costs for re-review shall be reimbursed to the County by deducting the cost from the Contractors monthly progress payments. Costs to be determined by applying the consultants standard billing rates, plus 10% handling by the County.

E. Substitution request to specified products will be made within 30 days of Notice to Proceed. After the 30 day period, no requests for substitutions from the Contractor will be considered.

1. Substitution submitted within the first 30 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for excepting the substitute.

F. Once electronic submittals are approved or approved as noted, they will be transmitted to the owner.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the Schedule of Values.

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, series of sheets, stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.

5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.

6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

B. Phasing: Provide notations on the schedule to show how the sequence of the work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.

C. Work Stages: Indicate important stages of construction for each major portion of the work, including testing and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of work performed as the dates used for preparation of payment requests.

1. Refer to Section Applications for Payment for cost reporting and payment procedures.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the project meeting room and temporary field office.

1. When revision are made distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

1.5 SUBMITTAL LOG

A. After development and acceptance of the Contractor's construction schedule, prepare a complete log of submittals.

1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.

2. Prepare the log in chronological order; include all submittals required. Provide the following information:

a. Scheduled date for the first submittal b. Related Section number
c. Submittal category
d. Name of subcontractor
e. Description of the part of the work covered
f. Scheduled date for resubmittal
g. Scheduled date for the Engineer's final release or approval.

3. All submittals must be received within the first 25% of contract time.

B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Log Updating: Revise the log after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Project Manager at weekly intervals:

1. List of subcontractors at the site
2. Approximate count of personnel at the site
3. High and low temperatures, general weather conditions
4. Accidents and unusual events
5. Meetings and significant decisions
6. Stoppages, delays, shortages, losses
7. Meter readings and similar recordings
8. Emergency procedures
9. Orders and requests of governing authorities
10. Change Orders received, implemented
11. Services connected, disconnected
12. Equipment or system tests and start-ups
13. Partial completions, occupancies
14. Substantial Completions authorized

1.7 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. All required dimensions
2. Identification of products and materials included
3. Compliance with specified standards
4. Notation of coordination requirements
5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings on sheets at least 8" x 11" but no larger than 24" x 36".
7. Number of Copies: Submit one (1) electronic copy of each submittal to the County's Representative, unless copies are required for operation and maintenance manuals. Submit one (1) electronic copy where copies are required for operation and maintenance manuals. Engineer will retain 1 electronic copy. Mark up and retain one returned electronic copy as a Project Record Drawing.
8. Submit one (1) hard copy once approved for legal seal stamping if needed at jobsite. Coordinate with Engineer and County's Representative.

9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.

C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.

2. Submit coordination Drawings for integration of different construction elements.
Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.

3. Contractor is not entitled to additional payments due to lack of compliance with this Section.

1.8 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawing".

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

a. Manufacturer's printed recommendations
b. Compliance with recognized trade association standards c. Compliance with recognized testing agency standards
d. Application of testing agency labels and seals
e. Notation of dimensions verified by field measurement
f. Notation of coordination requirements
g. Manufacturers local representative and phone number.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

4. Submittals: Submit six (6) copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.

   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's/Owner's Sample. Include the following:

   a. Generic description of the Sample
   b Sample source
   c. Product name or name of manufacturer
   d. Compliance with recognized standards
   e. Availability and delivery time

2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

   a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.

   b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

    a. Preliminary submittals will be reviewed and returned with the Engineer's/Owner's mark indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.

5. Maintain sets of Samples, as returned, at the project site, for quality comparisons throughout the course of construction.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
    b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field Samples specified in individual sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.

    a. Comply with submittal requirements. Process transmittal forms to provide a record of activity.

1.10 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Project Manager will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Engineer/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:

1. Final Unrestricted Release: Where submittals are marked No Exceptions Taken, that part of the work covered by the submittal may proceed provided it

complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

2. Final-But-Restricted Release: When submittals are marked Made Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

    a. Do not permit submittals marked Revise and Resubmit to be used at the Project site, or elsewhere where work is in progress.

4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01300

SECTION 01380 - CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Contractual Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. General: This Section specifies administrative and procedural requirements for construction photographs.

1.3 SUBMITTALS

A. General: Refer to Division 1 Section “Submittals” for general requirements for submitting photographs.

B. Prints: Submit 3 prints of each view directly to the Project Manager within 5 days of taking photographs. The Project Manager will distribute prints as follows:

1. One print to the Contractor shall be retained in the field office at the project site and available at all times for reference.

2. One print to the Owner as the Owner’s permanent record.

3. One print shall be retained in the Architect’s files.

C. Extra Prints: When requested by the Architect, the photographer shall submit extra prints of photographs, with distribution directly to designated parties who will pay the costs for the extra prints directly to the photographer.

D. Negatives: Retain the photographic negatives 3 years after date of Substantial Completion. During this period, the photographer shall fill orders by the Architect for extra prints. Extra prints shall be priced at prevailing local commercial prices.

1.4 QUALITY ASSURANCE

A. Engage a qualified commercial photographer to take photographs during construction.

B. Photographer’s Qualifications: Photographer shall be a firm or an individual of established reputation who has been regularly engaged as a professional photographer for not less than 3 years.

C. Associated Services: Cooperate with the photographer's work. Provide reasonable auxiliary services as requested, including access and use of temporary facilities including temporary lighting.

PART 2 PRODUCTS

2.1 PHOTOGRAPHIC COPIES

A. Provide 8" x 10" smooth surface gloss color prints on single-weight commercial- grade stock, mounted on muslin. Allow a 1" wide margin punched for standard 3- ring binder. Place margin on the left edge for vertical shots and at the top for horizontal shots.

B. Identification: Label each photograph on the front in the bottom margin with project name and date the photograph was taken. On the back of each print provide an applied label or rubber stamped impression with the following information:

1. Name of the Project
2. Name and address of the photographer
3. Name of the Architect
4. Name of the Contractor
5. Date the photograph was taken
6. Architect's Project No.

C. Description of vantage point, in terms of location, direction (by compass point), and evaluation of story on construction.

PART 3 EXECUTION

3.1 PHOTOGRAPHIC REQUIREMENTS

A. Take three (3) color project photographs at monthly intervals, coinciding with the cutoff date associated with each Application for Payment. The photographer shall select the vantage points for each shot each month to best show the status of construction and progress since the last photographs were taken.

B. Additional Photographs: From time to time the Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order, and are not included in the Contract Sum or an Allowance.

1. The Architect will give the photographer 3 days notice, where feasible.

2. In emergency situations, the photographer shall take additional photographs within 24 hours of the Architect's request.

C. Circumstances that could require additional photographs include, but are not limited to:

1. Substantial Completion of a major phase or component of Work.

2. Owner’s request for special publicity photographs.

3. Special events planned at project site.

D. Immediate follow-up when on-site events result in construction damage or losses. Photographs to be taken at fabrication locations away from project site; these are not subject to unit prices or unit-cost allowances. Extra record photographs at time of final acceptance.

E. Construction projects over $1,000,000 shall include at least one of the photographs listed in 3.01.A be aerial.

END OF SECTION 01380

SECTION 01400 - QUALITY CONTROL SERVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1-16 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Required inspection and testing services are intended to assist in the determination of probable compliance of the work with requirements specified or indicated. These required services do not relieve the Contractor of responsibility for compliance with these requirements or for compliance with requirements of the Contract Documents.

B. Definitions: The requirements of this section relate primarily to customized fabrication and installation procedures, not to the production of standard products. Quality control services include inspections and tests and related actions, including reports, performed by independent agencies and governing authorities as well as directly by the Subcontractor. These services do not include Contract enforcement activities performed directly by the Construction Manager or Architect or Engineer.

1) Specific quality control requirements for individual units of work are specified in the section of these specifications that specify the individual element of the work. These requirements, including inspections and tests, cover both production of standard products and fabrication of customized work. These requirements also cover quality control of the installation procedures.

2) Inspections, tests and related actions specified in this section and elsewhere in the Contract Documents are not intended to limit the Subcontractor's own quality control procedures which facilitate overall compliance with requirements of the Contract Documents.

3) Requirements for the Subcontractor to provide quality control services as required by the Construction Manager, A/E, the Owner, governing authorities or other authorized entities are not limited by the provisions of this section.

1.3 RESPONSIBILITIES:

A. Construction Manager and Subcontractor Responsibilities: Except where specifically indicated as being provided by another, identified entity, inspections, tests and similar quality control services are the Contractor's responsibility; these services also include those specified to be performed by an independent agency and not directly by the Subcontractor. Costs for these services shall be included in the Contract Sum., except

quality control services listed as being provided by the Construction Manager The Construction Manager shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services for the following ; soils compaction, soils moisture, sieve analysis, concrete, structural bolted and welded connections, mortar strength, masonry, and paving.

B. Retest Responsibility: Where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance of related work with the requirements of the Contract Documents, then retests are the responsibility of the Contractor, regardless of whether the original test was the Contractor's responsibility. Retest the work revised or replaced by the Contractor is the Subcontractor's responsibility, where required tests were performed on original work.

C. Responsibility for Associated Services: The Contractor is required to cooperate with the independent agencies performing required inspections, tests and similar services. Provide such auxiliary services as are reasonably requested. Notify the testing agency sufficiently in advance of operations to permit assignment of personnel. These auxiliary services include but are not necessarily limited to the following:
Providing access to the work. Taking samples or assistance with taking samples. Delivery of samples to test laboratories. Security and protection of samples and test equipment at the project site.

D. Coordination: The Contractor and each independent agency engaged to perform inspections, tests and similar services for the project shall coordinate the sequence of their activities so as to accommodate required services with a minimum of delay in the progress of the work. In addition, the Contractor and each independent testing agency shall coordinate their work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests. The Contractor is responsible for advising the Construction Manager at least 48 hours in advance of the required times for inspections, tests, taking of samples and similar activities.

1.4 QUALITY ASSURANCE:

A. Qualification for Service Agencies: Except as otherwise indicated, the engage inspection and test service agencies, including independent testing laboratories, which are pre-qualified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories and which are recognized in the industry as specialized in the types of inspections and tests to be performed.

1.5 SUBMITTALS:

A. Refer to Division 1 section on "Submittals" for the general requirements on submittals. Submit Four (4) copies of the certified written report of each inspection, test or similar service. Two (2) shall be submitted directly to the Construction

Manager and two (2) directly to the A/E. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

1) Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to the following:

- Name of testing agency or test laboratory.
- Dates and locations of samples and tests or inspections. Names of individuals making the inspection or test. Designation of the work and test method.
- Complete inspection or test data. Test results.
- Interpretations of test results.
- Notation of significant ambient conditions at the time of taking sample and testing.
- Comments or professional opinion as to whether inspected or tested work complies with requirements of the Contract Documents.
- Recommendations on retesting, if applicable.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 REPAIR AND PROTECTION:

A. Upon completion of inspection, testing, sample-taking and similar services performed on the work, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed finishes. Comply with the Contract Document requirements for "Cutting and Patching". Protect work exposed by or for quality control service activities, and protect repaired work. Repair and protection is the Subcontractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01631 - PRODUCT SUBSTITUTIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling request for substitutions made during bidding and after award of the Contract.

B. The Contractor's Installation Schedule and the Schedule of Submittals are included under Section "Submittals".

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: The Contract will be awarded based on the design, methods, materials and/or equipment as addressed in the Contract Drawings and/or described in the Contract Specifications, without any consideration for substitution or "or-equal" replacement. Addressing, describing or naming an item is intended to establish the type, function, characteristics and quality required in order to establish a base for bidding.

1. Within thirty (30) days after Contract award, the Contractor may submit for approval substitutes for any equipment and/or material. In addition to the product documents, a written certification shall accompany the documentation indicating that the proposed substitute will have the same characteristics, will perform in accordance with the design requirements and that complies with all the requirements set for in the Contract. Any additional information required by the Owner or County Representative shall be provided by the Contractor. Rejection of any proposed substitute will be considered final and the Contractor shall not get into any agreement with manufacturers or providers until the submittal has been finally approved.

2. The submission of this documentation shall follow the requirements set quality required in order to establish a base for bidding.

1.4 SUBMITTALS

A. Substitution Request Submittal: Request for substitution will be considered if received within thirty (30) days after contract award. As long as this time allowance will not impact the construction schedule.

1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:
    a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
    b. Samples, where applicable or requested.
    c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
    e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
    f. Cost information, including a proposal of the net change, if any in the Contract Sum.
    g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

3. Engineer's Action: Within two weeks of receipt of the request for substitution, the Engineer will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Engineer is considered final. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor’s substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise request will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

2. Proposed changes are in keeping with the general intent of Contract Documents.

3. The request is timely, fully documented and properly submitted.

4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered to the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

B. The Contractor's submittal and Project Manager's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the

Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

C. Substitution request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.

2. Will provide the same warranty for substitution as for specified product.

3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.

4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01631

SECTION 01700 - PROJECT CLOSE-OUT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:

1. Inspection procedures
2. Project record document submittal. (substantial completion requirements)
3. Operating and Maintenance Manual Submittal (substantial completion requirements).
4. Submittal of warranties (substantial completion requirement).
5. Final cleaning

B. Close-out requirements for specific construction activities are included in the appropriate Sections in Divisions 15 through 16.

C. Final Payment to be made when the County has reviewed and accepted all required close-out documents.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.

1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion in claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. Results of the completed inspection will form the basis of requirements for final acceptance.

2. Should the project fail to meet the standards required for Substantial Completion as defined in the documents, the Contractor will pay the expense of a second inspection by the Engineer and the Owner. Cost will be deducted from the Contractor's retainage.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following list exceptions in the request:

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and complete operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Engineer or Owner’s final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and the list has been endorsed and dated by the Project Manager.

4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been

completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certification of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposed; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owner's representative.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Submit one (1) hardcopy of the most current record set of drawings when the project is considered 50% substantially complete for review and comment by Owner.

5. Organize record drawing sheets, and print. suitable titles, dates and other identification on the cover of each set.

6. Provide three (3) additional sets of black line drawing sets of As-Built Drawings.

7. Provide one (1) CD-ROM with all As-Built Drawings in AutoCAD and PDF format.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.
Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that

are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.

1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.

D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Engineer for the Owner’s records.

E. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Engineer and the Owner’s personnel to determine which of the submitted Samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner’s Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into four (4) suitable sets of manageable size and electronically as PDFs on one (1) CD-ROM compact disc. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions
2. Spare parts list
3. Copies of warranties
4. Wiring diagrams
5. Recommended turn-around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLOSE-OUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. All items to be provided or competed prior to Certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.

B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

3.2 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide one (1) hardcopy.

B. Bind in commercial quality 8 ½" x 11" three ring binder, indexed with hardback, cleanable, plastic covers.
C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.

D. Provide table of contents: Neatly typed, in the following sequence:

1. Final Certificate of Occupancy
2. Warranty Service Subcontractors Identification List
3. Final Lien Waivers and Releases
4. Warranties and Guarantees
5. Systems Operations and Maintenance Instruction
6. Manufacturer's Certificates and Certifications
7. Maintenance Service Contracts
8. Spare Parts Inventory List
9. Special Systems Operating Permits or Approvals
10. Asbestos free materials notarized statement

E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.

F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work item.

G. Separate each section with index to sheets that are keyed to the Table of Contents listing.

H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.

I. Electronic Close-out DVD: At the completion of the project, submit one copy of a DVD with entire project close out information below in PDF format. All letter, legal and brochure size sheets shall be portrait and the As-build drawings will be landscape. All fonts will be Arial. All items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify words on the scanned documents.

1. Contacts: Set up a separate PDF for the contacts. No bookmarks are needed for this section.
2. As-Builts: All as-built drawings will be landscape.
3. Submittals: All technical submittal items (approved and approved as noted) will be provided and sorted by the 16 standard divisions. Bookmarks will be needed for the appropriate divisions.
4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (1-16). Please note that all items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify works on the scanned documents.
5. Permitting: This should include the Certificate of Occupancy and any other document that the Project Manager may include pertaining to the permitting for the project.

3.3 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

SECTION 01740 - WARRANTIES AND BONDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contractor Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General close-out requirements are included in Section "Project Close-Out".

3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in this document.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty. When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligation, rights, or remedies.

    1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The Owner reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.4 WARRANTY PERIOD

A. The Contractor shall participate with the County and the Engineer's representative, at the beginning of the tenth month of the warranty period, in conducting an onsite review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Engineer/Owner during on the site review.

B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.

C. Warranty period shall be manufacturer's standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.5 SUBMITTALS

A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Engineer's Certificate of substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the work, submit written warranties upon request of the Project Manager.

    1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen days of completion of that designated portion of the work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for executing by the required parties. Submit a draft to the Engineer for approval prior to final execution.

   1. Refer to individual Sections of Division 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3- ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2“ by 11" paper.

   1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

   2. Identify each binder on the front and the spine with the typed or printed title “WARRANTIES AND BONDS’, the Project title or name, and the name of the Contractor.

   3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01740

SECTION 16050 - BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
5. So that underground raceways that extend under the building grade slab are routed clear of footings, grade beams and similar including drainage provisions and the work of other trades. Where the number of sweeps or bends exceeds practical limits, furnish and install hand holes, manholes and similar appurtenances to facilitate the pulling in of cables.
6. So that raceways run “overhead” are located at elevations and in such a manner that does not interfere with the work of other trades or restrict proper use and access of the area or space in which the raceway is located. In particular locate circuitry to Connector Strips at a suitable elevation above the catwalks.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in

such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION 16050

SECTION 16060 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 3/0 stranded.
5. Bonding Conductor: No. 4, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for #10 AWG and smaller, and stranded conductors for #8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No.3/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners,

heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16072 - ELECTRICAL SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

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

1.2 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of component used.

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

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

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.

1. Manufacturers:

    a. Cooper B-Line; a division of Cooper Industries.
    b. ERICO International Corporation.
    c. Allied Support Systems; Power-Strut Unit.
    d. GS Metals Corp.
    e. Michigan Hanger Co., Inc.; O-Strut Div.
    f. National Pipe Hanger Corp.
    g. Thomas & Betts Corporation.
    h. Unistrut; Tyco International, Ltd.
    i. Wesanco, Inc.

2. Channel Dimensions: Selected for structural loading

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers:

        1) Cooper B-Line; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti, Inc.
        4) ITW Construction Products.
        5) MKT Fastening, LLC.
        6) Powers Fasteners.

2. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

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

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

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, unless requirements in this Section or applicable Code are stricter.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated by Code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: [Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts] [Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69] [Spring-tension clamps].
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.

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

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 3000-psi (20.7-MPa)], 28-day compressive-strength concrete.

END OF SECTION 16072

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Identification for conductors, communication, and control cable.
2. Warning labels and signs.
3. Equipment identification labels.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

A. Comply with NFPA 70, NFPA 70 E and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Fasteners for Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

F. Warning label and sign shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 mm)."
2. PPE Personnel protection equipment labels identifying level of hazard and the required protective items as prescribed by NEC 70 E.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

PART 3 - EXECUTION

3.1 APPLICATION

A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

B. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: [Self-adhesive, engraved, laminated acrylic or melamine label]. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear and switchboards.
c. Transformers.
d. Disconnect switches.
e. Motor starters.
f. Contactors.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS & CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, THHW and other insulation types as required based on the environment to which the conductor will be subjected.

2.2 CONNECTORS AND SPLICES

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.
6. Ilsco
7. NSI Industries – “Polaris Taps”

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

D. Where required due to limitations on the “approved termination devices” provided with equipment (approved for use by the AHJ, the contractor shall provided “transition boxes” and connectors to allow for the reduction of conductor size (oversized to account for voltage drop) to occur without voiding warranties or violating code limitations on wire bending space, clearance or cross sectional area limits.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.4 SLEEVE SEALS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Plastic, include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHW or THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHW or THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHW or THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHW or THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHW or THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHW or THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHW or THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHW or THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHW or THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Electrical Supports".

F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both wall surfaces.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint.

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services] for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16130 - RACEWAYS & BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. EMT: ANSI C80.3.

B. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Fittings for EMT: Steel, set-screw or compression type.

2.2 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

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

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Thomas & Betts Corporation.
    b. Walker Systems, Inc.; Wiremold Company (The).
    c. Wiremold Company (The); Electrical Sales Division.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.

C. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed: EMT.

2. Concealed in Ceilings and Interior Walls and Partitions: EMT (MC Cable may be used in interior walls only).
3. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.

B. Minimum Raceway Size: 3/4-inch (16-mm) trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

L. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

N. Set metal floor boxes level and flush with finished floor surface.

O. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION 16130

SECTION 31 10 00 -SITE PREPARATION AND EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all necessary labor, equipment, material and transportation and perform all work necessary to clear the construction site and bring the site, including roads, drives, building sites, paved areas and open areas to the lines and grades shown on Drawings.

1.2 RELATED WORK

A. Section 31 20 00, Excavating, Backfilling and Compacting

B. Section 32 92 00, Turf and Grass

C. Section 32 30 00, Asphalt Paving and Resurfacing

D. Section 32 40 00, Concrete Sidewalk

E. Section 33 10 00, Storm Drainage Syste

F. Section 32 41 00, Concrete Formwork

G. Section 03 30 00, Cast-in-Place Concrete

1.3 REFERENCED STANDARDS AND TESTS

A. AASHTO-T180 (ASTM D1557), Moisture-Density Relations of soils Using a 10 lb. Rammer and an 18-in. Drop.

B. AASHTO T191 (ASTM D1556), Density of soils in Place by Sand-Cone Method.

C. AASHTO T238 (ASTM D2922), Density of Soils and Soil-Aggregates in Place by Nuclear Method.

D. AASHTO M 145 (ASTM D3282), Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

1.4 QUALITY ASSURANCE

A. Field Engineering: Provide the services of a Professional Land Surveyor registered in the State of

Florida to establish all vertical and horizontal controls required for layout of the work and for preparation of a certified survey showing recorded finish elevations and dimensions upon completion of site preparation and earthwork.

B. Water Pollution: Comply with the applicable provisions of permits issued by Water Management District and Orange County Public Works. Protect adjacent waterways from contamination and increased turbidity due to Contractor's operations by all means necessary, including the installation of silt or turbidity screens, filter blankets, temporary dikes and ditches, etc., and limit runoff water from disturbed areas as necessary to meet requirements and restrictions of the agencies having jurisdiction.

C. Fill Materials: Submit certifications that fill materials furnished meet the specified requirements

and standards.

D. Compaction: During the filling operation, and unless otherwise required by Owner, take at least one density test per 5,000 square feet in pavement/roadway areas and building sites for each lift above water level and one density test per 25,000 square feet for each lift in other areas. If any test fails, rework and recompact the area and retest, until satisfactory compacting meeting the specified requirements are achieved.

PART 2 - PRODUCTS

2.1 MATERIALS FOR FILLS

A. Suitable for Fills: Material classified as A-1, A-3, or A-2-4 under AASHTO M 145 (ASTM D3282), free from vegetation and organic material, and with not more than 10 percent by weight passing the No. 200 sieve.

B. Suitable For Place In Water: Material classified as A-1 or A-3 under AASHTO M-145 (ASTM D 3282).

C. Unsuitable For Fills: Materials classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7 and A-8 under AASHTO M 145 (ASTM D3282).

D. Select Material: suitable material containing no pieces or rock fragments larger than will pass a 3-inch diameter ring.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clearing and Grubbing:

1. Completely remove and dispose of all trees, brush, stumps, roots, grass, weeds, rubbish and

   all other obstructions resting on or protruding through the surface of the existing ground and the surface of excavated areas.

2. Clear and grub within all areas of the roadway right-of-way, and all areas designated for site grading except where selective clearing will be transformed in some areas by retaining selected trees as designated on the Drawings or directed by Owner. Protect from damage by construction equipment and in a manner approved by Owner, all trees selected by the Owner for saving.

3. Within building sites and paved areas, remove to a depth of not less than 2-feet below the surface all stumps, roots, etc., protruding through or appearing on the surface of the existing ground and completed excavations, and replace with compacted backfill before the area is filled.

4. Within all other areas designated for clearing and grubbing, remove to a depth of 1-foot below the completed surface all stumps, roots, and other debris projection through or appearing on the surface of the ground.
5. Strip grass and roots to a depth of 4-inches from all areas to be excavated or filled upon. Stockpile for later use stripped material suitable for topsoil and dispose of all other material as

directed by Owner.

B. Debris Disposal: Prior to excavation and/or filling, remove from the project site and dispose of all clearing and grubbing debris and other accumulated trash.

3.02 PERFORMANCE

A. Excavation:

1 .Perform excavation to the limits indicated on the plans or specified herein, including shaping and sloping and other work necessary in bringing the earthwork to the required grades, alignment and cross sections.

2. As far as practicable, use all suitable materials removed from the excavation in the formation of the embankments, subgrades, shoulders, building sites and other places as directed. Remove unsuitable material to the required depth and replace it with suitable material to the satisfaction of Owner. Unsuitable material existing in open areas may remain, and these open areas may be used for disposal areas for the unsuitable material as directed by Owner.

3. Dispose of excess excavated suitable material as directed by Owner and excess unsuitable excavated material outside the limits of the project.

4. In the event materials containing toxic substances, oil products or other pollutants are encountered during excavation, immediately cease operations and notify Owner. Proceed with the excavation only when so directed by Owner, using additional procedures and precautions, if any, as necessary to contain and dispose of the contaminated material in compliance with all

applicable laws and regulations.

B. Fills:

1. Construct fills of suitable material placed in layers of not more than 8-inches in depth measured loose and rolled and/or vibrated with suitable equipment until compacted. Thickness of layers may be increased provided the equipment and methods used are proven by field density testing to be capable of compacting thicker layers to specified densities. Decrease layer thickness if equipment and methods used prove to be incapable of compacting layers to specified densities.

2. Place no material that will not pass through a 6-inch diameter ring within the top 12-inches of the surface of the completed fill, and none that will not pass through a 3-inch diameter ring within the top 4-inches of the completed fill. Do not use broken concrete or asphaltic pavement in fills.

3. Compact fill within the roadways, walkways, parking areas, and building sites to a density of not less than 95 percent of its maximum density as determined by AASHTO T 180 (ASTM D 1557), and fill within other areas to a density of not less than 90 percent.

4. Muck, marl or other unsuitable material may be used in open areas designated in the Drawings or as directed by Owner, disc and harrow this layer to break up large pieces of material. Compaction of unsuitable material will not be required.
5. Place and compact fills to within 0.1-foot of the required elevations and slope surfaces to drain as shown on the Drawings.

C. Subgrades:

1. Construct subgrades for paved areas to conform to the grades, lines and cross sections shown on the drawings, of uniform density, ready to receive the base course.

2. Stabilize, in accordance with Section 32 20 00, Stabilized Subgrade, all materials of the subgrade which provide a Limerock Bearing Ratio of less than 40.

3. After the subgrade has been properly shaped, and stabilized if required, bring the surface to a firm, unyielding surface by rolling the entire area with an approved vibratory roller. Compact all areas inaccessible to the roller with hand tampers weighing not less than 50 pounds, and with face area not more than 100-square-inches. Unless the subgrade material at the time of the rolling contains sufficient moisture to insure proper compaction, add water as directed before compacting. Allow subgrade material containing excess moisture, as determined by Owner, to dry to the proper consistency before being compacted.

4. Compact the top 12-inches of the subgrade, including cut and fill sections, to a density of not less than 95 percent of the maximum density as determined by the AASHTO T 180 (ASTM D 1557).

5. After the subgrade has been prepared, maintain it free of ruts, depressions and damage resulting from the hauling and handling of any material, equipment, tools, etc. Provide and maintain ditches or drains along the completed subgrade section to prevent damage by storm water. Just before the base course is laid, check the subgrade for crown and elevation. Complete the subgrade to provide a final elevation within 0.1-foot of the required elevation.

END OF SECTION 31 10 00

SECTION 31 20 00 - EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The work included under this Section consists of clearing, excavating, grading and backfilling as required for the construction of building pads, roadways, and utility systems consisting of water mains, sanitary sewers, lift stations and appurtenances and irrigation lines as shown on Drawings and specified herein.

B. Definitions:

1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.

2. Optimum Moisture: Percentage of water in a specific material at maximum density.

3. Suitable: Suitable materials for fills shall be a non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck. The Contractor shall furnish all additional fill material required.

4. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.

C. Plan for Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrate, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract.

1.2 QUALITY ASSURANCE

A. A Testing Laboratory employed by Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing shall be paid by the Owner. However, any and all test which have to be repeated because of the failure of the tested materials to meet specification shall be paid for by Contractor and the cost of any tests shall be deducted from payments due to Contractor.

1.3 JOB CONDITIONING

A. Test borings made on the site and the surface exploration data are available upon request and are for the Contractor's information only.

B. If, in the opinion of Owner, conditions encountered during construction warrant a change in footing elevation, or in the depth of removal of unsuitable material from that indicated on the Drawings, an adjustment will be made in the contract price.

1.4 PROTECTION

A. Sheeting and Bracing:

1. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect

adjacent structures, power poles, etc. from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If Owner is of the opinion that at any points sufficient or proper supports have not been provided, he may order additional supports put in at the expense of Contractor, and compliance with such order shall not relieve or release Contractor from his responsibility for the sufficiency of such supports. Where soils cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to Owner.

2. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by Contractor at his own expense so as to provide necessary clearances and dimensions.

3. Where sheeting and bracing is required to support the sides of excavations for structures, Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and certification of this shall be provided by the Professional Engineer.

4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.

5. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which Owner may direct in writing to leave in place at any time during the progress of the work for purpose of preventing injury to structures, utilities, or property, whether public or private. Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.

6. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by Owner.

7. The right of Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on this part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such an extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels.

The Contractor shall engage a Geotechnical Engineer registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to Owner for review a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and certification of this shall be provided by the Professional Engineer. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and required such modifications as maybe required to assure that the systems are performing satisfactorily.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

3. Water entering the excavation from surfaces runoff shall be collected in the shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

4. The Contractor shall take all additional precautions to prevent uplift of an structure during construction.

5. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by Owner or the authority having jurisdiction, at no cost to Owner.

6. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by Contractor.

8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on the groundwater quality.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. All fill material shall be subject to the approval of Owner.

2. All fill material shall be free of organic material, trash, or other objectionable material. Excess or unsuitable material shall be removed from the job site by Contractor.

B. Common Fill Material: Common fill shall be sand and shall not contain stones, rock, concrete to other rubble larger than two (2) inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.

C. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

U.S. Sieve Size	Percent Passing By Weight
1 - in	100
No. 4	75 - 100
No. 40	15 - 80
No. 100	0 - 30
No. 200	1 - 12

D. Class I Soils*: Manufactured angular, granular material, 1/4 to 1-1/2 inches (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 89 and with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
1/2	100
3/8	90 - 100
No. 4	20 - 55
No. 8	5 - 30
No. 16	0 - 10
No. 50	0 - 5

E. Class II Soils**:

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

3. SW: Well-graded sand and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

4. SP: Poorly graded sand and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

* Soils defined as Class I materials are not defined in ASTM D2487.
** In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
No. 10	100
No. 20	0 - 30
No. 40	0 - 5

G. Other Material: All other materials, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clearing:

1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth, within 10 feet of the lines of the excavation.

2. Strip and stockpile topsoil on the site at the location to be determined by Owner.

3.02 EXCAVATION

A. Excavating for Roadways and Utilities:

1. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.

2. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.

3. Encounters with subsurface obstructions shall be hand excavated.

4. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by Owner at the Contractor's expense.

5. The bottom of excavation shall be rendered firm and dry before placing any structure. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.

6. All pavements shall be cut prior to removal, with saws or approved power tools.

7. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.

8. All locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to Owner's approval of the Application for Payment for that work.

9. When force main or sanitary sewer pipe crosses less than 10 feet from a water main, the depth of cover shall be increased to 5 feet or 18 inches below the water main, which ever is greater. When force mains or sanitary sewers are laid parallel to water main, the sanitary line is to be installed per Section 22 20 00, Sanitary Sewerage System.

3.3 DRAINAGE

A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

B. All water pumped or drained from the work shall be disposed of in a suitable manner with our

undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete with in 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required at this expense to excavate below grade and refill with approved fill material if the Owner determines that adequate drainage has not been provided.

3.4 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due to the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction shall be as directed by Owner.

3.5 FILL AND COMPACTION

A. Compact and backfill excavations and construct embankment according to the following schedule. Backfill schedule for pipes is listed in Table 02200-A. (Standard shall be ASTM D-1557):

STRUCTURES AND ROADWORK

Area	Material	Compaction
Beneath Structures	Structural Fill	12" lifts, compacted to 95% maximum density. Fill should not be placed over any in place soils until those deposits have been compacted to 95% maximum density.
Around Structures	Structural Fill	8" lifts, 95% of maximum density. Use light rubber-tired or vibratory plate compactors.
From Cleared Existing Surface to Subgrade for Paved and Gravel Surfaces	Common Fill	12" lifts, 95% of maximum density.

B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.

D. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by Owner. Embankments shall be placed in successive layers of not mare than 8

inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface areas of each layer.

E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to Owner. Approval will be considered only after Contractor has performed tests, at Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. Owner's approval will be in writing.

END OF SECTION 31 20 00

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SECTION 31 31 00 – SOIL TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for termite control:

1. Soil treatment.

1.3 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.4 SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A pest control operator who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate.

1. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, and piers; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Masonry: Treat voids.

4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

F. Post warning signs in areas of application.

G. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 00

SECTION 32 20 00 - STABILIZED SUBGRADE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Where it fails to meet the specified Limerock Bearing Ratio (LBR) 40, stabilize the subgrade to the uniformity, density and bearing ratio specified hereinafter. Stabilize parking areas to a minimum depth of 6-inches below the bottom grade of the base material and to a width 6-inches outside each pavement or concrete curb edge.Stabilize roadways and streets to 12 inches unless otherwise indicated on the Drawings.

B. Definitions: Use FDOT Type B stabilization as described hereinafter to obtain the required bearing ratio by the addition and mixing in of suitable stabilizing material.

1.2 RELATED WORK

A. Section 31 10 00: Site Preparation and Earthwork

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use either Commercial Materials or Local Materials as defined hereunder, at the Contractor's option.

B. Commercial Materials: Limerock, overburden or crushed shell meeting the following requirements:

1. Limerock and Limerock Overburden: Material with at least 70 percentage of carbonates of calcium and magnesium, plasticity index not exceeding 10 and 97 percent of passing a 1 1/2-inch sieve.

2. Crushed Shell: Mollusk shell (i.e., oysters, mussels, clams, cemented coquina, etc.) meeting the following requirements.

   a. At least 97 percent by weight of the total material passing a 1-inch screen and at least 50 percent by weight of the total material retained on the No. 4 sieve.

   b. Not more than 7.5 percent by weight of the total material passing the No. 200 sieve as determined by washing the material over the sieve.

   c. In the event that the shell meets the above requirements without crushing, crushing will not be required. The use of steamed shell will not be permitted.

C. Local Material: High-bearing-value soils or sand-clay material with the portion passing the 40-mesh sieve having a liquid limit not greater than 30 and a plasticity index not greater than 10. Blending of materials to meet these requirements will not be permitted unless authorized by Owner. When permitted, test and obtain approval for the blended material before using.

D. Stabilization:

1. Determine bearing value by the Limerock Bearing Ratio (LBR) Method.
2. After grading operations are substantially complete, determine the quantity (if any) of selected stabilizing material to be added for compliance with the bearing value requirements.

3. Ensure that the finished subgrade meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:

1. Prior to the beginning of stabilizing operations, complete the subgrade to the lines, grades and cross section shown in the plans.

2. Stabilize the subgrade in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction and other desired results, in which case, perform the processing in more than one course as approved by Owner.

3.2 APPLICATION

A. Stabilizing Material: Spread the stabilizing material uniformly over the area to be stabilized by means of mechanical material spreaders, except that where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of Owner.

B. Mixing: By means of rotary tillers, or other equipment meeting the approval of Owner, thoroughly mix the subgrade throughout the entire depth and width of the area to be stabilized.

C. Maximum Particle size of Mixed Materials: At the completion of mixing, check that all particles of material within the limits of the area to be stabilized pass a 3 1/2-inch ring. Remove from the stabilized area any particles not meeting this requirement or break them down so as to meet this requirement.

D. Compaction: After the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, compact the stabilized area to a density of not less than 98% of maximum density as determined by AASHTO T 180. Compact the materials at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either add water or allow drying until the proper moisture content for the specified compaction is reached.

E. Finish Grading: Grade and shape the completed stabilized subgrade to conform with the finished lines, grades and cross-section indicated in the Drawings.

F. Quality Assurance:

1. After the stabilizing and compaction operations have been completed, check that the subgrade is firm and substantially unyielding, to the extent that it will support construction equipment and will have the bearing value required.

2. Remove and replace with suitable material all soft and yielding material, and any other portions of the sub-grade which will not compact readily, and bring the whole subgrade to line and grade, with proper allowance for subsequent compaction.

G. Maintenance Of Completed Subgrade: upon completion, maintain the subgrade free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. Maintain the required density until the subsequent base or pavement is in place. Make any repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to re-compact the subgrade in the event of under-wash or other damage. Construct and maintain ditches and drains as necessary to protect the completed subgrade from damage by storm water.

3.3 FIELD QUALITY CONTROL

A. Bearing Value Requirements:

1. General: Bearing value samples will be obtained and tested by Owner at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the Drawings, in excess of the tolerances established herein, spread and mix in additional stabilizing material as specified above for the full width of the roadway being stabilized and longitudinally for a distance of 50-feet beyond the limits of the area in which the bearing value is deficient. Pay for all retesting required until subgrade meets the specified requirements.

2. Tolerances In Bearing Value Requirements: A under tolerance of 5.0 from the specified bearing value of LBR 40 will be allowed as based on tests performed on samples obtained after mixing operations have been completed.

END OF SECTION 32 20 00

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SECTION 32 30 00 - ASPHALT PAVING AND RESURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION

A. Extent of asphalt concrete paving work is shown on drawings.

B. Prepared aggregate subbase is specified in earthwork sections.

1.3 SUBMITTALS:

A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

B. Contractor to provide part of Base Bid and submitted to the Architect and SBBC's representative.

- Determination of the job mix formula
- Tests of the asphalt cement
- Sieve analysis of the aggregate
- Determination of bitumen content of the asphalt concrete

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with State Department of Transportation standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

1.5 SITE CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg. F (10 deg. C), and when temperature has not been below 35 deg. F (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt concrete surface course when atmospheric temperature is above 40 deg. F (4 deg. C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg. C) and rising.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

B. Base Course Aggregate: Limerock or cemented coquina shell meeting Florida Department of

transportation Specification Sections 911 or 915, respectively. See Soils Report.

C. Surface Course Aggregate: Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand.

D. Sand prepared from stone, blast-furnace slag, or gravel, or combinations thereof may be used if required to suit local material availability.

E. Asphalt Concrete: Shall comply with Florida Department of Transportation Specifications, Section 331, Type S-1 for parking areas. See Soils Report.

F. Prime Coat: Shall comply with Florida Department of Transportation Standard Specifications, Section 300.

G. Herbicide Treatment: Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid, or wettable powder form.

H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Allied Chemical Corp.
Achem Products, Inc.
Ciba-Geigy Corp.
Dow Chemical U.S.A.
E.I. DuPont De Nemours & Co., Inc.
FMC Corp.
Thompson-Hayward Chemical Co.
U.S. Borax and Chemical Corp.

I. Lane Marking Paint: Use Thermoplastic type paint.

J. Wheel Stops: Precast of 3,500 psi air-entrained concrete, approximately 6" high, 9" wide, and 7'0" long, with chamfered corners and drainage slots on underside.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

A. Remove loose material from compacted subbase surface immediately before applying herbicide treatment or prime coat.

B. Proof roll prepared subbase surface to check for unstable areas and areas requiring additional compaction.

C. The moisture content of the base is not to exceed 90 percent of optimum to obtain adequate penetration for the prime coat.

D. Notify Engineer of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

E. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subbase prior to application of prime coat.

F. Prime Coat: Apply at rate of 0.20 to 0.50 gal. per sq. yd., over compacted subgrade. Apply

material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile.

G. Tack coats shall only be required on primed bases in areas that have become excessively dirty and cannot be cleaned, or in areas where the prime has cured to the extent that it has lost adequate bonding. Generally, a tack coat will be required on bituminous base or leveling courses before placing the surface course. No traffic shall be allowed on the tacked surface.

H. Tack Coat: Apply to contact surfaces of previous constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface. Allow to dry until at proper condition to receive paving.

I. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.2 PLACING MIX

A. General: Place asphalt concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225 deg. F (107 deg. C). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. The depth of each layer to be checked by the Contractor at intervals not to exceed 25”. All deviation from the required thickness in excess of the allowable tolerance shall be corrected immediately. Surface courses of thickness greater than 2” to be constructed in approximately equal layers and of less than 2” compacted thickness. No skin patching shall be allowed. The density required for asphaltic concrete pavement, after final compaction, shall be at least 95 percent of the laboratory compacted density of the paving mixture. Tests shall be performed every 500’ for roadways and 50,000 SF for parking areas.

B. Paver Placing: Place in strips not less than 10' wide, unless otherwise acceptable to Owner. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

C. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.3 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement. While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements. Should any depressions remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface. All high spots, joints, and honeycomb shall be corrected. Any mixture which becomes loose or broken, mixed, or coated with dirt, or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.

Where sand-asphaltic shoulders are constructed within the limits of curb and gutter, specify that compaction shall be done by light weight rolling equipment which will not displace the previously constructed curb and gutter.

The finished surface shall not vary more than 3/16” when measured by a 15’ rolling or manual straightedge applied parallel to the center line of the pavement. Any surface irregularities exceeding such limits shall be corrected. A manual straightedge shall be furnished by the

Contractor and shall be available at all times during the course of the work. The corrections made by replacement of the full thickness shall extend to at least 50' past each side of the defective area.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling or joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.4 TRAFFIC AND LANES MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping: Use thermoplastic type for lane-marking paint, factory-mixed, quick-drying, and non-bleeding. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommend rates.

C. Color: Yellow.

D. Do not apply traffic and lane marking paint until layout and placement has been verified with Owner.

3.5 WHEEL STOPS

A. Secure wheel stops to asphalt concrete surface with not less than two 3/4" diameter galvanized steel dowels embedded in precast concrete at 1/3 points. Size length of dowel to penetrate at least 6" into asphalt concrete. Drill placement holes oversize and embed dowels in hot bituminous grout material.

3.6 FIELD QUALITY CONTROL

A. General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Owner.

B. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

1. Surface Course: 1/4", plus or minus.

C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of pave area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

1. Wearing Course Surface: 1/8".

2. Check surface areas at intervals as directed by Owner.

D. Allowable deficiencies from the specified thickness and serious deficiency thicknesses.

- 1-1/2" or less

  i. Maximum allowable deficiency — 3/16" or more
  ii. Serious deficiency — 1/4" or more

- Greater than 1-1/2" but less than 2-1/2"

  i. Maximum allowable deficiency — 1/4" or more
  ii. Serious deficiency — 3/8" or more

- 2-1/2" or greater

  i. Maximum allowable deficiency — 1/2" or more
  ii. Serious deficiency — 3/4" or more

END OF SECTION 32 30 00

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SECTION 32 40 00 - CONCRETE SIDEWALK

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, material equipment and transportation and perform all work necessary for the construction of the sidewalks to the lines and grades as shown on Civil Engineering Drawings.

B. RELATED WORK

1. Section 31 10 00, Site Preparation and Earthwork
2. Section 03 30 10, Cast-in-Place Concrete for Site Work
3. Section 32 41 00, Concrete Formwork

1.3 SUBMITTALS

A. Submit, in accordance with Division 1 certificates by the producers or manufacturers that the furnished materials meet the specific requirements of the Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: Class A (3000 psi) conforming to the requirements of Section 03 30 10.

B. Welded Wire Fabric: As specified in Section 32 42 00.

C. Preformed Joint Filler: Non-extruding and resilient bituminous type conforming to the requirements of ASTM D 1751.

D. Membrane Curing Compound: Clear fugitive dye conforming to the requirements of AASHTO M 148. Type I-D, Class A.

PART 3 - EXECUTION

3.1 PREPARATION

A Maintain the finished sub grade in a smooth, compact condition and restore any areas which are disturbed prior to placing of the concrete. Remove large boulders and other obstructions to a minimum depth of 6 inches below the finished sub grade elevation, and backfill the space with sand, base course maternal or other suitable material thoroughly compacted by rolling or tamping.

B. Trim the sub grade accurately to the required elevation with a ¼- inch tolerance. Trim high areas to proper elevation. Fill low areas with suitable material and compact to the specified density, or fill with concrete integrally with the placing of the pavement.

C. Setting Forms: Set the forms accurately to line and grade and so that they rest firmly throughout their length, upon the compacted sub grade surface. Join forms neatly and tightly and brace them to resist the pressure of the concrete and the finished operations. Obtain the Engineer's approval for the alignment and grade of all forms before and immediately prior to the placing of concrete.

D. Slip forming: The slip forming method will be allowed, provided that an acceptable finished product, true to line, grade, and cross section is consistently produced.

E. Vapor Barrier: Cover sub grade with vapor barrier prior to concrete placement.

F. Mixing Concrete: Mix in accordance with the requirements of Division 3 - Concrete.

3.2 INSTALLATION

A. Placing Concrete:

1. Distribute the concrete on the sub grade to such depth that when it is consolidated and finished, the thickness required by the Civil Engineering Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface. Deposit the concrete on the sub grade in a manner which will require as little re-handling as possible and is continuous between transverse joints, without the use of intermediate bulkheads.

2. Final Finish: As soon as the water sheen has disappeared and just before the concrete becomes non-plastic, finish all edges, including expansion joint edges, with an edging tool having a radius of ½-inch. Finally give the top a light broom finish perpendicular to the forms.

B. Joints:

1. Transverse Construction Joints: Construct at the end of all pours and at other locations where the pouring operating are stopped for as long as 30 minutes, but not within five feet of any other transverse joint or of either end of a section of walk. If sufficient concrete has not been placed to form a slab at least five feet long, remove the excess concrete, back to the last preceding joint. Form the joints by placing a wood or metal bulkhead accurately and securely in place, in a plane perpendicular to the profile and center line of the walk. Tool edges of construction joints with a ½ -inch radius.

2. Transverse Construction Joints: Form at five foot intervals as planes of weakness created by an edging tool. Cut the fresh concrete perpendicular to the surface of the walk, to a depth of 1-1/2 inches below the top surface and tool edges to ½ -inch radius.

3. Transverse Expansion Joints: Form by placing preformed joint filler, one-half inch thick around all structures and at intervals not exceeding 100 feet.

C. Curing:

1. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, cover the entire surface and the edges of the newly placed concrete and cure with membrane curing compound.

2. Apply curing compound uniformly to the surfaces to be cured, in a continuous film, at the rate of application and in the manner recommended by the manufacturer.

3. Do not apply the curing compound during periods of rainfall. Should the film become damaged from any cause within the required curing period, immediately repair the damaged portions with additional compound. Upon removal of side forms immediately coat the sides of the slabs exposed, providing a curing treatment equal to that provided for the surface.

D. Form Removal: After the concrete has sufficiently set a minimum of 12 hours, remove the forms and backfill the space on each side. Compact and grade the earth in a satisfactory manner

without damage to the concrete work. Fill honeycombs with sand cement mortar. Plastering will not be allowed on the face of the walk. Remove rejected walk and replace without additional compensation.

END OF SECTION 32 40 00

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SECTION 32 41 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The work included in this Section consists of providing formwork for cast-in-place concrete.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Section 32 42 00:Concrete Reinforcement
2. Section 03 30 10:Cast-in-Place Concrete for Site Work
3. Section 03 60 00: Grout

1.2 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

1. Standard Building Code.

2. ACI 347 Recommended Practice for Concrete Formwork.

3. Responsibility: The Contractor shall be responsible for the design of the formwork and for safety in its construction, use and removal.

4. Tolerances: Formwork shall be constructed to insure that finished concrete surfaces will be in accordance with the tolerances listed in ACI 347. Camber shall be provided as necessary to compensate for anticipated defection in formwork and concrete due to weight and pressure of fresh concrete and other construction loads.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms:

1. Forms shall be of wood, steel or other approved materials, and as specified in this Section. The sheeting for all exposed surfaces shall be 5-ply plywood, unless otherwise specifically authorized. Forms of like character shall be used for similarly exposed surfaces in order to produce a uniform appearance. Forming for exposed exterior concrete from 1-foot below finished exterior grade to top of structure shall be carefully fabricated so as to provide a smooth finish without defects.

2. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of Owner. If it is his opinion that the interior surfaces of the forms are too irregular to produce the specified finish, they shall be lined with smooth dense, moisture resistant hardboard or other material of which he approves.

B. Plywood: Unless otherwise indicated, forms shall be PLYFORM, Class 1, BB-Exterior type, mill oiled and edge sealed. Thickness shall be as required to support concrete at the rate place, but not less than 3/4-inch.

C. Form Accessories: Form accessories shall be of a commercially manufactured type.
1. Form ties shall be so constructed that the ends, or end fasteners, can be removed without causing appreciable spalling at the faces of the concrete.

2. After ends, or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 1 1/2-inches from the formed face of the concrete. Use embedded rods with integral waterstops and cones.

3. Wire ties and wood spreader will not be permitted.

D. Chamfer Strips: Chamfer strips shall be polyvinyl strips or other approved material designed to be nailed in the forms to provide a 3/4-inch chamfer at exposed edges of concrete members.

E. Form Release Agent: form release agent shall be a paraffin base oil or mineral oil coating that will effectively prevent absorption of moisture and prevent bond with concrete, will not stain the concrete surfaces, and will leave the concrete with a paintable surface.

PART 3 - EXECUTION

3.1 INSTALLATION/ERECTION

A. Forms

1. Construction:

a. Forms shall be built true to line and grade, and shall be mortar tight and sufficiently rigid to prevent displacement or sagging between supports. Particular attention shall be given to adequacy of supports and shoring, which is the Contractor's responsibility. The surfaces of forms used for permanently exposed surfaces shall be smooth and free from irregularities, dents, sags or holes. Forms for surfaces to receive stucco finish shall be suitable for its application.

b. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges at expansion joints or at any other corners that are to remain. Beams below grade shall have forms at both sides.

c. Bolts and rods used for internal ties shall be so arrange that, when the forms are removed, all metal is a least 1-1/2 inch from any concrete surface. Form ties shall be removed immediately after removal of forms, and holes shall be thoroughly plugged with grout within 24 hours after form removal and kept damp for 4 days to prevent shrinking.

d. Wire ties will not be permitted.

2. Form facing Materials: The facing material shall produce a hard form texture on the concrete. Facing materials with raised grain, torn surfaces, worn edges, patches, dents or other defects shall not be used. The maximum deflection of facing materials as reflected in concrete surfaces shall not exceed 1/240 of the span between structural members.

3. Preparation of Form Surfaces: After each use and prior to placing reinforcing, forms shall be cleaned of mortar, grout and other foreign material and the form release agent shall be

applied. Form releasing agent shall not be allowed to stand in puddles in the forms or allowed to come in contact with hardened concrete against which fresh concrete is to be place.

4. Coating: Prior to the placing of steel reinforcement or concrete, forms for exposed surfaces shall be coated with a non-staining paraffin base oil or mineral oil. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete.

B. Adjustment: Positive means of adjustment of shores and struts shall be provided and all settlement shall be taken up during concrete placing.

C. Temporary Openings: Temporary openings shall be provided in wall forms to limit the free fall of concrete to a maximum of 4 feet unless an elephant trunk is used. such openings shall be located to facilitate placing and consolidation and shall be spaced no more than 8 feet apart. Temporary openings shall also be provided in the bottom of wall and column forms and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.

D. Construction Joints: At construction joints, the contact surfaces of the form sheathing shall overlap the hardened concrete by not less than 1 inch. Forms shall be held against the hardened concrete to prevent offsets or loss of mortar.

E. Chamfers: All exposed concrete edges shall be chamfered 3/4-inch by 3/4-inch, unless otherwise indicated on the Drawings.

F. Runways: Smooth and rigid runways shall be provided (if needed) for moving equipment and concrete. Runways shall be supported directly on formwork or on grade and in no case on reinforcing steel or bar supports.

G. Footings, Grade Seams and Slab Edges: Exterior faces of footings, grade beams, walls and slab edges shall be formed with plywood.

H. Embedded Item: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing, blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to concreting.

I. Pipes and Wall Spools Cast in Concrete:

1. Install wall spools, wall flanges and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.

2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during construction.

J. Form Removal: Formwork shall not be removed from any concrete until it has obtained a minimum of 3,000 psi compressive strength to support itself and any live loads it may be subjected to, and then only with the approval of Owner.

END OF SECTION 32 41 00

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SECTION 32 42 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The work included in this Section consists of providing reinforcing steel for cast-in-place or pre-cast concrete structures for site work.

B. Related Sections: The following sections contain requirements that related to this section:

1. Section 32 41 00: Concrete Formwork
2. Section 03 40 00: Pre-cast Concrete Structure

1.2 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements of the current editions of the following standards:

1. Standard Building Code.

2. ACI 318 Building Code Requirements for Reinforced Concrete.

3. ACI 315 Details and Detailing of Concrete Reinforcement.

4. CRSI Manual of Standard Practice, MSP-2.

1.3 SUBMITTALS

A. Complete shop drawings shall be submitted to Owner for review in accordance with General Conditions, including bar lists and placing drawings. Drawings shall show the type, spacing and location of metal bar supports, the grade of the reinforcing and the name of the manufacturer. The type of coupler splice devices shall be designated.

PART 2 - PRODUCTS

2.1 MATERIALS

A Reinforcing Steel:

1. Reinforcing steel shall conform to the requirements of ASTM Designation A 615, Deformed Grade 60, except where otherwise indicated.

   a. The name of the manufacturer of the reinforcing steel shall be called out in the shop drawings together with a sketch showing the pattern of the deformation, including the mill mark.

   b. Bar reinforcement shall be accurately fabricated in accordance with the latest CRSI Manual of Standard Practice. The Contractor shall have prepared and shall submit to the Contracting Officer in sextuplicate, necessary shop drawings and bar lists. The Contractor shall be responsible for errors made in shop drawings even though approved by the Contracting Officer.

B. Supports:

1. Metal Bar Supports:

a. Bar supports for reinforcing steel shall conform to the requirements of CRSI Manual of Standard Practice, Chapter 3 and shall be of a height to furnish the concrete cover called for on Drawings. High chairs shall be furnished for bent or top bars in solid slabs. Bar supports to be in contact with exterior surfaces of concrete shall be Class C with plastic caps at least 1-inch in length on the leg tips, or Class E with stainless steel legs. Bar supports shall be spaced not more than 100 times the diameter of the bars to be supported, with not more than 1/4 spacing from the end of the supported bars to the firs chair.

b. Bar supports for slabs on grade shall be plain concrete blocks, 3-inches high by 4-inches square with the tie wires embedded in support. Concrete strength shall be at 3,000 psi at time of use.

2. Cold-drawn wire for spirals shall be plain and shall conform to the requirements of ASTM Designation A 82 with a minimum yield strength of 70,000 psi.

2.2 FABRICATION

A. Fabrication shall not begin until the approval of the shop drawings by Owner has been received. Fabrication shall meet all requirements of the specified standards. Unless otherwise indicated the following shall apply:

1. Hooks shall be standard hooks.

2. Bottom bars shall extend a minimum of 6 inches into supporting members.

3. Cover is to the outermost stirrup, tie or bar.

4. Splices are permitted only where indicted on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Reinforcing Steel: When placed in the forms, reinforcement shall be clean and free of all rust, scale, dust, dirt, paint, oil or other foreign material and shall be accurately and securely positioned in the forms as shown on the Drawings before the placing of concrete. Reinforcing steel shall be wired or otherwise fastened together at intersections and shall be supported by concrete or metal supports, spacers or hangers. Bar supports, where adjacent to the ground, shall be set on pre-cast concrete pads compressed into the subgrade. The Contractor shall obtain Owner's approval before fastening reinforcing steel at intersections by welding methods.

1. Splicing of reinforcement shall be held to a minimum and shall be placed at points of minimum stress. Bars shall be lapped at splices a minimum of 24 bar diameters unless otherwise shown on the Drawings or directed by Owner, and shall be rigidly wired or clamped.

B. Embedded Items: In addition to steel reinforcement, pipes, inserts and other metal objects as

shown, specified or ordered shall be built into, set in or attached to the concrete. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before concrete is placed, care shall be taken to determine that all embedded parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. No wood shall be embedded in concrete. The concrete shall be packed tightly around pipes and other metal work to prevent leakage and to secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete.

C. Supporting Reinforcing: Bar supports shall be provided as required by CRSI MSP-2 and ACI-315. Top and bottom bars in slabs formed on earth shall be supported on pre-cast concrete block supports except where such bars are properly supported from formwork. Pre-cast concrete block supports are not required in slabs formed on tremie concrete but may be used at the Contractor's option.

D. Placing Reinforcing: Placing of reinforcing and welded wire fabric shall be as indicated on the Drawings and as recommended by CRSI MSP-2 and ACI 315. Reinforcing shall be securely tied and supported to prevent displacement during concrete placement.

E. Dowels: Dowels shall be wired in position prior to placing concrete.

F. Field Bending: Heat shall not be used to bend bars. Bars shall not be bent after being embedded in concrete.

G. Welding: Welding of reinforcing will not be permitted.

H. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

END OF SECTION 32 42 00

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