PROJECT MANUAL

Persigo WWTP Internal Fiber Optic Loop

Project #: 10372769

Issued for Bid

Prepared For:	Prepared By:	Date:
City of Grand Junction	HDR	May 2024

SECTION 00 01 10

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DIVISION 01

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PART 1 - GENERAL

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6. Work by City.
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B. Related Requirements:
1. Include, but are not limited to, the following:
a. Section 01 14 19 - Use of Site

1.2 LOCATION AND DESCRIPTION OF WORK

A. The Work is located entirely at the Persigo Wastewater Treatment Plant, 2145 River Road, Grand Junction, CO 81505.

B. The Project includes constructing the Work broadly described below, in accordance with the Contract Documents, with all related appurtenances. Work shown on the Drawings, or indicated in the Specifications, or indicated elsewhere in the Contract Documents is part of the Work, regardless of whether indicated below. The Work includes, but is not limited to, the following:
1. Installation of a cross-site 4-way underground microduct system to allow interconnection of the facility's buildings with a fiber optic network. The microduct system includes in-ground handholes and a tracer wire for locating the microduct in the future.
2. Installation of fiber optic cable through the microduct system and termination of fiber optic cables at buildings on the WWTP site that house control system components.
3. Installation of pullboxes and fiber patch panels at buildings that will be interconnected by the fiber optic network.
4. Installation of conduits inside building to carry the fiber optic cable to the fiber patch panel locations, and empty conduits from the fiber patch panel locations to network equipment locations inside the buildings.
5. Associated paving, concrete and civil improvements associated with installation of microduct.

C. Contracting Method: The Project will be constructed under a single prime construction Contract.

D. Hazardous Environmental Conditions:
1. To the best of City's knowledge, information, and belief, the Site has been a wastewater treatment facility since 1984, when existing buildings at the Site were constructed.

1.3 CONSTRUCTION CONTRACTS FOR THIS PROJECT

A. Single Prime Construction Contract: The Contract requires all the Work for the Project not expressly allocated to City or others in the Contract Documents.

1.4 OTHERS RETAINED BY CITY FOR THE PROJECT

A. Engineer:
   1. Engineer is identified in the Contract.
   2. Engineer's responsibilities for the Project, relative to Contractor, are indicated throughout the Contract Documents.
   3. Whether the Engineer will furnish the services of a Resident Project Representative (RPR) for the Project is indicated in the Supplementary Conditions.

1.5 WORK BY OTHERS UNDER CITY'S CONTROL - OTHER PROJECTS

A. Other construction contracts have been or will be awarded by City that are in close proximity to or border on the Work of this Project. Work under these other contracts is briefly described in this Article.

B. Indicate name and contract designation of other project: Persigo WWTP Expansion
   1. Principal Work Location: Persigo Wastewater Treatment Plant.
   2. Scope:
      a. Project involves construction of the following:.
         1) Headworks Electrical Building
         2) Aeration Building and Aeration Basins
         3) Dewatering Building
         4) Modifications to the UV system
         5) Entrance gate and access road improvements along the east side of the plant site.
         6) The project scope includes rehabilitation of the Headworks and construction of a new Headworks Electrical Building; rehabilitation and expansion of the Aeration Basins; construction of a new Blower Building and pipe gallery; Construction of a new Dewatering Building, and construction of a new UV disinfection system.
   3. Contract times expected to start running onFebruary 2024
   4. Approximate Substantial Completion: December 31, 2025
   5. Approximate Final Completion: March 1, 2026.
   6. The construction of the fiber optic system will overlap, at least in part, with the WWTP Expansion project, and in particular at the new facilities that are constructed in the WWTP Expansion that require connections to the fiber optic network.

1.6 WORK BY OTHERS NOT UNDER CITY'S CONTROL

A. Work by Utility Owners and Transportation Facility Owners:
   1. City is aware of the work indicated below, to be performed at or adjacent to the Site, by utility owners (not under City's control) or owners of transportation facilities (not under City's control).
      a. None.

1.7 WORK BY CITY

A. City will perform the following in connection with the Work:
   1. Provide, install, and configure network switches to be connected to the fiber optic network.
   2. Provide fiber optic patch cords to connect network switches to fiber patch panels and install the patch cords through Contrator-provided empty conduits.
   3. Configure existing control system equipment to interface with the new fiber optic network.

1.8 SEQUENCE AND PROGRESS OF WORK

A. Sequencing:
   1. Incorporate sequencing of the Work into the Progress Schedule.
   2. Sequencing Requirements:
      a. Coordinate installation of fiber optic network to, and through, new facilities that are being constructed in the Persigo WWTP Expansion project.

1.9 CONTRACTOR'S USE OF SITE

A. Use of Site - General:

1. Limits on Contractor's use of the Site are indicated in Section 01 14 19 - Use of Site, and as may be shown on the Drawings.
2. Contractors shall share use of the Site with other contractors and others specified in Articles 1.3 through 1.6 (inclusive) of this Section.
3. Relocate stored materials and equipment that interfere with operations of City, other contractors, and others performing work for City.
4. Comply with restrictions set forth in Section 01 14 19 - Use of Site.

B. City will occupy the Site jointly with Contractor during construction for performance of City's typical operations. Coordinate with City in all construction operations to minimize conflicts between Contractor and City's employees and others under City's control. City will have City's suppliers for deliveries of chemicals and other items accessing the Site from time to time, possibly on a daily basis.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 14 19
USE OF SITE

PART 1 - GENERAL

1.1 SUMMARY

1. Section Includes: Restrictions on Contractor's use of the Site and premises.
2. Restrictions on use of existing buildings and structures, including:
   a. Permanent utilities and sanitary facilities.

B. Scope:
1. Contractor shall provide all labor, materials, equipment, tools, and incidentals shown, specified, and required to comply with restrictions on Contractor's use of the Site and other areas.
2. Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions, regarding the Contractor's use of the Site and other areas.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
   a. Site plan showing proposed location of field offices, storage trailers, staging and laydown areas, temporary sanitary facilities, fuel and oil storage, fueling location, bottle gas storage facilities, and other areas Contractor proposes to occupy, if any.

1.3 USE OF PREMISES

A. Limit use of premises at the Site to work areas shown or indicated on the Drawings and as specified in this Section. Do not disturb portions of the Site beyond areas of the Work.
1. Limits:
   a. Confine construction operations to the following areas:
      1) Limits shown on the Drawings.
   b. Confine storage of materials and equipment, and locations of temporary facilities to the following areas:
      1) Contractor's gang boxes and storage containers for tools in active use in the Work may be kept in reasonable quantity in the work areas as long as such items do not obstruct access to the facilities by City or occupants.
      2) Do not store items of any sort, whether temporarily or otherwise, in stairways and ramps, whether existing or under construction.
      3) Areas on site identified by City for use by Contractor for material and equipment storage and laydown. Contractor storage and laydown areas must be coordinated and not interfere or inhibit construction activities on the Persigo WWTP Expansion project.
   c. Do not enter the following areas:
      1) Outside of the limits of construction indicated on the Drawings.
      2) Areas outside of the work areas indicated in Paragraph A.1.a of the "Use of Premises" Article in this Specifications section, and outside of work areas indicated on the Drawings, including outside the Project areas indicated on the "key plan" in the Drawings.
      3) Areas identified by City as prohibited.
      4) Areas that interfere with construction activities on the Persigo WWTP Expansion project.
2. Prohibitions:
   a. Do not use the Site for the following:
      1) Conducting Contractor's business not related to the Project or other work for City.

2) Overnight lodging or other, non-work use of the Site by workers or others for whom Contractor is responsible, whether housed in recreational vehicles, other vehicles, tents, quarters in field offices or Contractor-furnished temporary structures, or in work areas, is unacceptable.

B. Use of Existing Buildings and Structures: Maintain existing buildings and structures in weather-tight condition throughout construction unless otherwise indicated in the Contract Documents. Protect buildings, structures, and occupants during construction.
   1. Use of Existing Utilities, Sanitary Facilities, and First-aid Facilities:
      a. Do not use permanent sanitary facilities, whether provided under the Project or existing prior to the Project, at the Site.
      b. Do not use permanent telephone, Internet, or other communications utilities and facilities at the Site, regardless of whether such services and facilities were provided under the Project or existed prior to the Project, except in cases of emergency.
      c. Do not use City's or occupants' first-aid facilities, except in cases of medical emergency. Promptly replenish used items and supplies with items identical to those used.

C. Promptly repair damage to premises, including existing structures, finishes, equipment, and other features, caused by construction operations. Upon completion of the Work, restore premises to specified condition; if condition is not specified, restore to pre-construction condition.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements applicable to all bid/pay items.
   2. General provisions on unit prices and quantities.
   3. General provisions on lump sums.
   4. Listing of the various bid/pay items in the Project, together with criteria for measuring Unit Price Work for payment

1.2 REQUIREMENTS APPLICABLE TO ALL BID/PAY ITEMS

A. In this Section and elsewhere in the Contract Documents, the terms “bid item”, “pay item”, “bid/pay item”, “Item” followed by a number designation, “this item”, and the like all have the same meaning, and refer to one or more specific elements of the Contract, established for pricing and payment, as indicated in the Bid Form and in the Agreement (or exhibit to the Agreement) at the time the Contract was signed by the parties.

B. This Article applies to all bid/pay items in the Contract.

C. Prices – General:
   1. The bid/pay items listed starting with Article 1.5 of this Section refer to and are the same bid items listed in the Bid Form and included in the Contract, and constitute all bid/pay items for the Work at the time the Contract was signed by the parties.

2. No direct or separate payment will be made, outside of the bid/pay items in the Contract, for the following: providing miscellaneous temporary or accessory materials or equipment, temporary works, temporary construction facilities, Contractor's project management, superintendence, and similar costs for Subcontractors or Suppliers; bonds and insurance; schedules and schedule updates; coordination (with: City's operations (including, but not limited to, lockout/tag-out procedures), other contractors, utility owners, owners of transportation facilities, adjacent property owners and occupants, authorities having jurisdiction, Subcontractors and Suppliers, and others with whom Contractor is to coordinate the Work); information technology systems required by the Contract Documents; Submittals; photographic documentation; Project meetings; Contractor's hazard communication program; Contractor's compliance with environmental procedures for Constituents of Concern (including spill control and countermeasures plans and implementation); professional services (required for Contractor's means and methods of construction, and for delegated designs required by the Contract Documents); obtaining and complying with permits and licenses; temporary utilities (including electric power, water supply and disposal, fuel, and communications); temporary lighting; temporary fire protection; temporary enclosures and HVAC; temporary sanitary facilities; temporary first-aid facilities and services;Contractor's field offices and sheds, Engineer's field offices (when required elsewhere in the Contract Documents); temporary vehicular access and parking (including access to the Site, temporary access roads and parking, onsite traffic controls for construction traffic, and offsite haul routes); traffic control of non-construction vehicular and pedestrian traffic; temporary controls (including temporary erosion and sediment controls, noise control, control of storm water, surface water, and groundwater, pollution controls (including solid waste control, water pollution control, and control of atmospheric pollution), dust control, pest and rodent controls, odor controls, and other temporary controls required by the Contract Documents); temporary security for the Work; temporary barriers; Project signage (when required elsewhere in the Contract Documents); delivering, handling, and storing materials and equipment to be incorporated into the Work; layouts and surveys for the Work; construction equipment, machinery, tools, and vehicles; safety and protection; Site maintenance during construction; cleaning and removal and disposal of waste and debris; checkout and startup; testing and other quality control activities required by the Contract Documents; record documents, operation and maintenance data; warranties; spare parts and extra materials required by the Contract Documents; instruction of facility personnel as required by the Contract Documents; commissioning (when required elsewhere in the Contract Documents); Contractor's correction period, Contractor's general warranty and guarantee; Contractor's indemnification obligations; other labor, cost, or effort required by the General Conditions and Supplementary Conditions, Division 01 Specifications, and other requirements of the Contract Documents.
3. Price Escalation:
    a. Unless expressly indicated otherwise in the Contract Documents, City is not obligated to change the stipulated prices (including lump sums, unit prices, and allowances) that are all or part of the Contract Price because of escalation of costs when there is no corresponding change in the Contract Times.
    b. Changes in the Contract Times do not necessarily entitle Contractor to a change in Contract Price due to escalation.
4. Compensation for all services, labor, materials, and equipment shall be included in prices stipulated for the lump sum and unit price bid/pay items in the Contract.
5. Each lump sum and unit price in the Contract shall include an amount considered by Contractor as sufficient for all overhead and profit for each separately identified bid/pay item.

D. Contract Price, Payment Procedures, and Related Matters:
1. Contract Price: The Contract Price, as apportioned among bid/pay items in the Contract, is indicated in the Agreement and may be modified by Change Order.

2. Payments to Contractor: Refer to the General Conditions (as may be modified by the Supplementary Conditions), the Agreement (including provisions on retainage, if any), among other applicable Contract Documents.
3. Procedures for Changes in Contract Price: Refer to the General Conditions (as may be modified by the Supplementary Conditions).
4. Defective Work is not eligible for payment.

1.3 GENERAL PROVISIONS ON UNIT PRICES AND QUANTITIES

A. Quantities:
1. Quantities of Unit Price Work indicated in the Bid Form and in the Contract (at the time the Agreement was signed by the parties) are estimates for purposes of pricing and comparison of Bids.
2. City does not represent, either expressly or by implication, or agree that the nature of materials encountered below ground surface or in concealed areas, or actual quantities of Unit Price Work required, will correspond with the quantities in the Contract at the time the Agreement was signed by the parties. City reserves the right to increase or decrease quantities, and to eliminate quantities, as City may deem necessary or as may be necessary due to Site conditions encountered.
3. Quantities eligible for payment will be actual quantities furnished and installed (as applicable) in accordance with the Contract Documents, within the pay limits shown or indicated, as measured by Engineer (or other entity so empowered in the Contract Documents), and recommended for payment by Engineer.
4. At Contractor's expense, Contractor may independently verify quantities measured by Engineer for payment. Should Contractor disagree with quantities measured and recommended for payment by Engineer, submit appropriate Change Proposal (appealing Engineer's measurements) indicating the specific reasons for Contractor's appeal, with detailed reasons therefor and associated calculations and estimates, in accordance with the Contract Documents.
5. Quantity Overruns:
    a. When the quantity of a pay item of Unit Price Work eligible for payment exceeds the pay item's quantity included in the Contract, City will pay for quantities that exceed those in the Contract only while the estimated total payments to Contractor under the Contract will not exceed the Contract Price. Otherwise, a Change Order is required to modify the associated quantity in the Contract, thus changing the Contract Price.
6. Except as may be established elsewhere in the Contract Documents, make no claim for anticipated profit, loss of profit, damages, or additional compensation arising from difference between quantities of Unit Price Work eligible for payment and the estimated quantities in the Contract.

B. Measuring for Payment:
1. At Engineer's option, Engineer may delegate to Owner's Site Representative (OSR) (if any), some or all of Engineer's responsibilities for measuring Unit Price Work eligible for payment.
2. Unless expressly indicated otherwise in the Contract Documents, measurements will be in United States standard measurements.
3. Unless indicated otherwise elsewhere in the Contract Documents, quantities of Unit Price Work eligible for payment will be rounded to the nearest whole number.
4. Assistance with Measurements:
    a. Assist Engineer and Owner's Site Representative (OSR) (if any), by providing measuring equipment, labor, and survey personnel necessary to measure quantities eligible for payment.
5. Quantities eligible for payment can be adjusted by Engineer to correct quantities included in Contractor's prior payment requests, and for incomplete or defective Unit Price Work. Such corrections are at Engineer's sole discretion.
6. Apportionment of Unit Prices for Partial Payments:

a. At Owner's sole discretion, Owner may elect to make partial payments for one or more pay items of Unit Price Work, prior to completion of the Work for the measured quantity. For example, where a unit price includes excavation, backfill, and restoration, Owner may elect to pay a part of the unit price for completed excavation and backfill, prior to Contractor performing the required restoration, with the balance of such payment made after completion of the associated restoration Work.
b. As precondition to determining amounts eligible for such partial payment of a unit price, Owner or Engineer may require Contractor to submit information, acceptable to Engineer, apportioning the unit price into various, associated work activities, similar to breakdown of lump sum prices in the Schedule of Values. When requested, Contractor shall promptly submit such information and documentation to Engineer.
c. Owner is not obligated to make partial payments for any pay item of Unit Price Work unless the entire scope of the associated Unit Price Work is reasonably complete and recommended for payment by Engineer.

1.4 GENERAL PROVISIONS ON LUMP SUM ITEMS

A. Progress payments for Work paid on a lump sum basis will based on Engineer's estimate of the Work (in accordance with the Contract Documents) performed through the end of the associated pay period, based on the Schedule of Values accepted by Engineer in accordance with the Contract Documents.

B. At its sole discretion, Engineer may correct amounts of lump sum Work included in prior payment requests based on improved data or information available to Engineer, or Engineer's knowledge or reasonable belief that Work is incomplete or defective.

1.5 BID/PAY ITEMS – GENERAL CONTRACT

A. The following is a summary of bid items listed on the project Bid Form with general description of the items included in each bid item. All Unit Price bid items shall include costs for all materials and direct labor for installation of the bid item. Refer to Bid Form for additional information.
1. Bid Item A – Microduct (Unit Price)
a. Installation of 4-way microduct using directional bore, microtrenching, or other installation method, supplemental #10AWG tracer wire, installation of warning tape in open-cut trenching methods, and surface restoration to pre-project conditions.
b. Testing of microducts.
2. Bid Item B – Handholes (Unit Price)
a. Installation of precast handholes with interior accessories, microduct connections inside the handholes, including surface restoration around the handholes to pre-project conditions.
3. Bid Item C – Building Exterior-Mounted Pullboxes (Unit Price)
a. Installation of pullboxes mounted on exteriors of buildings, including conduit from below grade, building-entrance conduit, and any associated surface restoration (to prep-project conditions) related to the microduct installation into the pullbox.
4. Bid Item D – Exterior Unistrut-Mounted Pullboxes (Unit Price)
a. Installation of pullboxes installed on Unistrut racks at locations other than buildings (gates, grease facility, gas flares), including concrete slab foundations for the Unistrut racks, conduit from below ground, racking materials, and surface restoration to pro-project conditions.
5. Bid Item E – Fiber Patch Panels (Unit Price)
a. Installation of fiber patch panels at all locations, including accessory items and termination of all fiber strands at each fiber patch panel.
b. Testing of all fiber optic cables and connections/terminations from each fiber patch panel to the fiber patch panel on the opposite end of the fiber optic cable.
6. Bid Item F – Building Interior Conduit (Unit Price)

a. Installation of 1" RGS conduit in building interior locations for routing of fiber optic cables from exterior pullboxes to fiber patch panel locations in the building interiors, including all fittings, supports, and accessories.

7. Bid Item G – Exterior Conduit (Unit Price)
   a. Installation of 1" RGS-PVC conduit on building exteriors between pullboxes and fiber patch panel enclosures or between pullboxes and building entry locations.
8. Bid Item H – Fiber Optic Cable (Unit Price)
   a. Installation of 24-strand single-mode fiber optic cable inside microducts, handholes, pullboxes, and conduit to each fiber patch panel.
9. Bid Item I – Lump Sum Items (Lump Sum)
   a. This Bid Item includes all items not specifically defined in the Unit Price items, including General Conditions costs, preparation of submittals and other project paperwork, mobilization, demobilization, insurance, bonding, Contractor overhead and profit, and similar project indirect costs.

B. Measurement
   1. Unit Price items will be measured per each completed unit for location-specific items (e.g. handholes), and for length of each completed segment of linear items (e.g. length of a microduct segment between two handholes).
   2. Lump Sum items will be measured by estimated percentage completion of the overall project.

C. Payment
   1. Unit Price items will be paid for each completed unit for location-specific items (e.g. handholes), and for each completed segment of linear items (e.g. a microduct segment between two handholes).
   2. Lump Sum items will be paid based on estimated percentage completion of the overall project.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements applicable to all substitution requests.
   2. Provisions specific to Contractor's substitution requests for:
      a. Materials and equipment to be incorporated into the Work.
      b. Methods, procedures, and sequences indicated in the Contract Documents.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals, and pay all costs associated with requests for approval of substitutes.
   2. Where the Contract Documents expressly indicate that substitutes are not allowed, are unacceptable, or time-barred, do not submit substitution requests for such items or procedures.
   3. Requirements for Contractor's proposal of "or-equals", where allowed by the Contract, are in the General Conditions, as may be modified by the Supplementary Conditions or requirements in this Section.

1.2 REFERENCES

A. Terminology:
   1. The following terminology, although not indicated with initial capital letters, has the following meaning in this Section:
      a. "Or-equal" and "or equal" each means material or equipment items to be incorporated into the completed Work as a functioning whole, or method, procedure, or sequence that, in Engineer's sole opinion, are equivalent to that shown or indicated in the Contract Documents.
      b. "Substitute" means proposed materials or equipment to be incorporated into the completed Work as a functioning whole, or a proposed construction method, procedure, or sequence that is not, in Engineer's sole opinion, equivalent to the associated, similar material or equipment item or method, procedure, or sequence shown or indicated in the Contract Documents, but accomplishes the same or similar purpose. Unless expressly indicated otherwise in the Contract Documents, Contractor's proposals for "value engineering" (and similar terms) are substitutes.
      c. "Substitution request" means Contractor's written request for Engineer's approval of a proposed substitute, in accordance with this Section. Substitution requests are separate from Shop drawings and other Submittals required by the Contract Documents.

1.3 SUBSTITUTES - GENERAL

A. This Article applies to all substitutes and substitution requests, whether for substitute materials or equipment, or for substitute methods, procedures, or sequences.

B. This Section expands on the provisions on substitutes in the General Conditions, as may be modified by the Supplementary Conditions.
   1. Contractor's Request; Governing Criteria: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

a. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
b. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
c. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
    1) Will certify that the proposed substitute item will:
        a) Perform adequately the functions and achieve the results called for by the general design;
        b) Be similar in substance to the item specified; and
        c) Be suited to the same use as the item specified.
    2) Will state:
        a) The extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
        b) Whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
        c) Whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
    3) Will identify:
        a) All variations of the proposed substitute item from the item specified; and
        b) Available engineering, sales, maintenance, repair, and replacement services.
    4) Will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

2. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
3. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
4. Reimbursement of Engineer's Cost: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
5. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

6. Effect of Engineer's Determination: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

C. Time Limits for Submitting Substitution Requests:
   1. Where the Contract allows Contractor's substitution requests, such proposals will be considered by Engineer only during a period of 60 days after the date the Contract Times start to run, unless otherwise indicated.
   2. Substitution requests will be accepted for consideration by Engineer after the time limit indicated in the paragraph above this, when materials or equipment shown or indicated, and all associated "or-equals", are either:
      a. Unavailable; or
      b. Despite Contractor's due diligence, are unavailable in time for the Work to be completed within the Contract Times.
   3. The foregoing notwithstanding, substitutes will not be approved when received by Engineer after Contractor has commenced the associated Work at the Site, where approval of the substitute would require rework or removing Work already installed.

D. Design Professional:
   1. Engineer is responsible for design of the completed Project as a functioning whole and has responsible charge of the Project except for Work for which design responsibility is expressly delegated by the Contract Documents.
   2. Do not retain services of any third-party design professional to prepare modifications of Engineer's design of the completed Project as a functioning whole without Engineer's express, written consent via an appropriate Contract modification setting forth appropriate performance and design criteria for delegating the design of the substitute.

E. Contractor's Representations:
   1. In submitting each substitution request, Contractor represents that:
      a. Contractor has read and understands the Contract's provisions on substitutes, as indicated in this Section, and elsewhere in the Contract Documents.
      b. Substitution request is complete and includes all documents and information required by the Contract Documents.
      c. Contractor certifications required by this Section are valid and made with Contractor's full knowledge, information, and belief.
      d. Contractor will provide the same or better guarantees and warranties for substitute as for the specified materials, equipment, methods, procedures, and sequences (as applicable).
      e. Contractor waives all rights for increasing the Contract Price or extending the Contract Times, related to the substitute, that subsequently may become apparent to Contractor after issuance of the associated Contract modification instrument approving such substitute, except for those associated with differing subsurface or physical conditions or discovery of a previously unforeseen Hazardous Environmental Condition associated with the Work involving the approved substitute.

F. Submittal of Substitution Requests - General:
   1. Substitution requests must be submitted by Contractor. Engineer will not accept or review substitution requests from prospective or bona-fide Subcontractors or Suppliers.
   2. Submit separate substitution request for each proposed substitute.
   3. Submit substitution requests in accordance with requirements for Shop Drawings and other Submittals, as indicated in Section 01 33 00 - Submittal Procedures, and Section 01 31 26 - Electronic Communication Protocols.
   4. Do not submit substitution requests as any of the following (such substitution requests will be returned by Engineer without review):
      a. Shop Drawing, Sample, or other Submittal.

b. Request for approval of an "or-equal".
c. Request for interpretation (RFI) or clarification.
d. Change Proposal without all other, required substitution request elements indicated below.
e. Other oral or written communication not in accordance with this Section.

5. Each substitution request shall include:
   a. Transmittal letter (one per substitution request) expressly indicating the communication is a substitution request.
   b. Completed substitution request form, on the form attached to this Section.
   c. Change Proposal, submitted in accordance with the Contract Documents. Clearly indicate the proposed changes in Contract Price and Contract Times if substitute is approved; if none, clearly so indicate on the Change Proposal.
   d. Certifications and written representations required by the Contract Documents to accompany substitution requests.
   e. Other information: (1) required elsewhere in this Section and in other elements of the Contract Documents, and (2) deemed appropriate by Contractor to support Contractor's substitution request.
6. When Engineer requires additional information to evaluate a substitution request, furnish such information within five days of receipt of Engineer's request, unless additional time is granted by Engineer, in writing.
7. Engineer and City have the right to rely upon the completeness and accuracy of information, documents, certifications, and representations in Contractor's substitution request. Contractor accepts full responsibility for completeness and accuracy of substitution requests (except for Engineer's professional liability).

G. Engineer's Review of Substitution Requests:
1. Engineer has no obligation to approve any substitute.
2. Substitutes will not be approved unless all of the following are satisfied for the associated substitute:
   a. The Contract supports submittal of such substitution request; and
   b. Substitute is reasonably consistent with Engineer's design intent for the Project as a completed, functioning whole; and
   c. As indicated in Paragraph 1.3.B of this Section.
   d. Substitute will not have an adverse effect on the work of other contractors, or existing or proposed construction; and
   e. Substitution request is complete in accordance with the Contract Documents and Engineer's requests, and
   f. City agrees to the substitute; and
   g. Associated changes in Contract Price and Contract Times, if any, are acceptable to City.
3. Engineer is not obligated to approve any substitute where such approval is conditioned on an increase in the Contract Price, the Contract Times, or both.
4. Timeliness of Engineer's Review:
   a. Allow not less than 21 days for Engineer's review of each substitute. Allow longer for larger, more-complex substitutes.
   b. Engineer will endeavor to perform timely review of substitution requests. However, Contractor is responsible for complying with the Contract Times, regardless of whether the substitute is approved.
   c. Where approval of a substitute would necessitate other changes to the Project's design, additional time, beyond that indicated above, will be necessary for Engineer's preparation of revisions to the design.
5. When Design Changes are Required with Approval of Substitute:

a. Engineer will advise Contractor promptly following Engineer's review (and City's comment, if any) on substitution request to indicate whether the substitute will be acceptable. Engineer's advisory to Contractor will indicate whether changes in Engineer's design are necessary and include a preliminary estimate of Engineer's fee and time required for modifying the design and preparing an associated Proposal Request to Contractor.
b. Engineer's preliminary estimates of fee and time for design modifications will be prepared in good faith, but are not binding on City or Engineer.
c. Contractor shall reimburse City for costs incurred by City for design modifications necessitated by approval of substitute. City may deduct such amounts, as one or more set-offs, from payments due Contractor under the Contract.
d. Upon Contractor's receipt of Engineer's estimate of fee and time for design modifications, Contractor shall advise Engineer, in writing, within three days whether Contractor will continue pursing approval of the substitute.
e. Engineer may reject a substitute that would require substantial changes in the Project's design.

H. Approval of Substitutes:
1. Substitutes are approved only via issuance of an appropriate Field Order or Change Order in accordance with the General Conditions, as may be modified by the Supplementary Conditions.
2. Approval of a substitute does not relieve Contractor from obligation to comply with the Contract Documents, including submitting Shop Drawings, Samples, and other Submittals in accordance with the Contract Documents.

1.4 SUBSTITUTE MATERIALS AND EQUIPMENT

A. In addition to other requirements of this Section and elsewhere in the Contract Documents, substitution requests for substitute materials or equipment shall include:
1. Manufacturer and Location:
a. Name and address of manufacturer of the proposed substitute. Indicate country where manufacturer is incorporated and owned.
b. Companies and brands owned by or affiliated with manufacturer.
c. Name of manufacturers of principal component items, such as motors, bearings, and similar items.
d. Location where the items would be manufactured, including country and address. Indicate the total percentage of the items' value that will be manufactured outside of the United States and its territories.
e. Name, address, and driving distance from the Site of:
1) Manufacturer's sales representative.
2) Nearest service center offering full array of service capabilities.
3) Warehouse or other location where spare parts for the proposed substitute are available.
f. Number of years that manufacturer has actively participated the North American market.
2. Proposed Materials and Equipment:
a. Model designation and quantity of each proposed for the Work.
b. Manufacturer's literature for proposed substitute, with description of the materials and equipment.
c. Performance information and representative test data.
d. Indication of reference standards with which materials and equipment comply.
e. Preliminary process and instrumentation diagrams (P&ID), where applicable.
f. Identification of hazardous materials, including Constituents of Concern, used in the materials and equipment, and associated permitting or licensing required.
g. Manufacturer's standard warranty and applicable, proposed special or extended warranties, including indication of specific entities that will be beneficiary of such warranties.

h. Complete list of proposed deviations from requirements of the Contract Documents.
i. Itemized comparison of specified materials and equipment and proposed substitute, indicating:
    1) Size (physical dimensions) when: item is in use, when not in use, and space required for routine and major maintenance.
    2) Weight and loading at supports, when item is full and empty.
    Materials of construction.

3. Operation requirements, including:
    a. Anticipated consumption of each item of: Electricity, other energy sources, water, chemicals (indicate each), and other needs for operation at the Site.
    b. Typical labor required for operation and associated skill level.
    c. Description of remote monitoring and control capabilities, as applicable.
4. Maintenance requirements, including:
    a. Anticipated life in the service and environment required.
    b. Frequency and general scope of routine and major maintenance typically necessary.
    c. Typical labor requirements and general qualifications of personnel performing routine maintenance.
    d. Major, associated equipment necessary for routing and major maintenance, including hoisting equipment type and capacity (when applicable).
    e. Availability, scope, cost, and general conditions of service and maintenance contracts, if any.
5. References for similar projects on which the materials and equipment were used. Indicate for each:
    a. Project owner name, name of facility where installed, and name of project.
    b. City, state, and country of installation.
    c. Model number/size and quantity furnished and installed.
    d. Year of installation.
    e. Contact information for owner and design professional, including telephone numbers.
6. Other information required by the Contract Documents.
7. Other information reasonably requested by Engineer.

1.5 SUBSTITUTE CONSTRUCTION METHODS, PROCEDURES, OR SEQUENCES

A. Provisions of the General Conditions, as may be modified by the Supplementary Conditions, regarding substitutes of materials and equipment are hereby extended to apply to substitute methods, procedures, and sequences as shown or indicated in the Contract Documents.

B. In addition to other requirements of this Section and elsewhere in the Contract Documents, substitution requests for substitute methods, procedures, or sequences shall include:
1. Clear identification of the method, procedure, or sequence shown or indicated in the Contract Documents for which substitute is requested.
2. Detailed description of proposed substitute method, procedure, sequence, or combination thereof.
3. Reasons why substitute is proposed and benefits to the Project should the substitute be approved.
4. Detailed list of how the proposed substitute deviates from associated method, procedure, or sequence shown or indicated in the Contract Documents.
5. Impact of the substitute, if approved, on City's or facility manager's operations, when the Work is at an existing facility.
6. Effect on other contractors working at the Site, if substitute is approved.
7. Description of temporary equipment and temporary facilities needed, should the substitute be approved, including quantity of items, capacities, performance characteristics, permitting and approvals required by authorities having jurisdiction, and proposed location at the Site.
8. Written evaluation of how substitute method, procedure, or sequence complies with Laws and Regulations.
9. Drawings illustrating method, procedure, or sequence.

10. Materials to be used that contain Constituents of Concern or that have potential to cause or exacerbate a Hazardous Environmental Condition.
11. Other information and data required by the Contract Documents.
12. Other information reasonably required by Engineer.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The following, bound after this Section's "End of Section" designation, are part of this Specifications Section:
   1. Exhibit A - Substitution Request Form (one page).

END OF SECTION

EXHIBIT A

Substitution Request Form
(One Item per each Form)

Project:	Date:	
Substitution Requestor:		
Contractor:		
Specification Section No:	Paragraph No. (i.e. 2.1.A.1.c):	Specified Item:
Proposed Substitution:		
Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.		
State differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.		
Document how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract		
Describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?		
Describe what effect the proposed substitution has on the Construction Schedule and Contract Time.		
Describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.		
Manufacturer's guarantees of the proposed and specified items are: ☐ Same ☐ Different (explain on attachment)		
The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.		

For use by Engineer:

☐ Accepted – eligible for approval via Change Order

☐ Accepted as Noted – approval via Change Order

☐ Not Accepted

_____ _____

Date *(Telephone)*:

_____

Signature of PE, RA, or PG in Responsible Charge

_____

(Contractor's Signature)

_____

(Contractor's Firm)

_____

(Firms Address)

_____

(Telephone)

Comments:

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preconstruction, progress and other project meetings.

B. Related Sections include but are not necessarily limited to:

1.2 PRECONSTRUCTION MEETING

A. Meet with the City and Engineer for a pre-construction conference at a time mutually agreed upon after the contract is awarded, but before any work is performed,

B. The Engineer will schedule a meeting of the City, Contractor, Contractor's Subcontractors, and their respective representatives.

1. The purpose of the meeting will be to clarify construction contract administration procedures, to establish lines of authority and communication and identify duties and responsibilities of the parties.

C. The Engineer will schedule the pre-construction conference after receipt of the Contractor's draft proposed schedule.

D. Agenda:

1. Procedural and Administrative:
    a. Personnel and Teams:
        1) Designation of roles and personnel.
        2) Limitations of authority of personnel, including personnel who will sign Contract modifications and make binding decisions.
        3) Subcontractors and Suppliers in attendance.
        4) Authorities having jurisdiction.
    b. Procedures for communications and correspondence, including electronic communication protocols.
    c. Copies of the Contract Documents and availability.
    d. The Work and Scheduling:
        1) General scope of the Work.
        2) Contract Times, including Milestones (if any).
        3) Phasing and sequencing.
        4) Preliminary Progress Schedule.
        5) Critical path activities.
    e. Safety:
        1) Responsibility for safety.
        2) Contractor's safety representative.
        3) Emergency procedures and accident reporting.
        4) Emergency contact information.
        5) Confined space entry permits.
        6) Hazardous materials communication program.
        7) Impact of Project on public safety.
    f. Permits.
    g. Review of insurance requirements and insurance claims.

h. Coordination:
    1) Coordination of Subcontractors and Suppliers.
    2) Coordination with City's operations.
    3) Progress meetings – schedule and frequency.
    4) Coordination meetings.
i. Submittals:
    1) Current critical Submittals:
        a) Preliminary Schedule of Submittals.
        b) Other schedules (Progress Schedule, Schedule of Values).
        c) Preconstruction photographic documentation.
        d) List of proposed Subcontractors and Suppliers.
        e) List of emergency contact information.
        f) Notice of elements of Contractor's safety program with which City and Engineer are to comply.
        g) Site use plan.
        h) Form of Contractor's site superintendent's daily reports.
    2) Work not eligible for payment without approved or accepted Submittals (as applicable).
    3) Submittal procedures.
        a) Compliance with accepted Schedule of Submittals.
        b) Actions required of Contractor prior to furnishing Shop Drawings and other Submittals.
        c) Contractor's Submittal approval stamp required; Contractor's coordination of Submittals.
        d) Furnishing of Submittals.
        e) Submittal types and meaning of Engineer's action on each.
        f) Resubmittals—responsibility for, limitations on quantity.
    4) Identification of initial, critical Shop Drawings and product data.
    5) Construction photographic documentation.
j. Substitutes and "Or-Equals":
    1) Product options.
    2) Procedures for proposing "or-equals".
    3) Procedures for proposing substitutes.
k. Contract Modification Procedures:
    1) Requests for interpretation.
    2) Written clarifications.
    3) Field Orders.
    4) Proposal Requests.
    5) Change Proposals.
    6) Work Change Directives.
    7) Change Orders.
    8) Differing site conditions or discovery of Hazardous Environmental Condition.
    9) Substantiating and documenting Change Proposals and Claims.
    10) Claims.
l. Progress Payment:
    1) City's Project financing and funding, as applicable.
    2) City's tax-exempt status.

3) Preliminary Schedule of Values
4) Procedures for measuring for payment (Unit Price Work).
5) Retainage.
6) Progress payment procedures; documents to accompany Applications for Payment.
7) Payment for stored items not yet installed.
8) Date of City's payments; payment is due.

m. Subcontractors and Suppliers:
1) List of proposed Subcontractors and Suppliers; monthly updates.
2) Coordination and management.
3) Subcontracts and purchase orders.

n. Testing and inspections:
1) City-hired and contractor-hired.
2) Identification of City-hired testing entity and special inspectors.
3) Responsibility for advising testing entity and special inspectors of need for services.
4) Results of code-required special inspections and tests.
5) Prompt remedy of apparent defects.
6) Notice of defective Work.
7) Remedy of defective Work.
8) Defective Work not eligible for payment.
9) Covering up defective Work.
10) Cost responsibility for defective Work and retesting/re-inspection.

o. Disposal of demolition materials.
p. Record documents.
q. Preliminary discussion of Contract closeout:
1) Procedures for Substantial Completion.
2) Partial utilization procedures; property insurance.
3) Contract closeout requirements.
4) Correction period; duration of Contractor's general warranty and guarantee.
5) Duration of bonds and insurance.

2. Authorities Having Jurisdiction (if not covered in a separate meeting):
a. Municipal licenses.
b. Municipal permits required.
1) Permits required and status.
2) Inspections for building code official.
3) Code-required special inspections and tests (if not covered in Administrative and Procedures part of meeting).

c. Right-of-way work permits; status of occupancy permit(s).
d. Environmental permits:
1) Spill prevention control and countermeasures plan (40 CFR 112).

3. Site Mobilization (if not covered in a separate meeting):
a. Working days, working hours, and overtime.
b. Use of Site and other areas; use of existing facilities.
c. Field offices, storage trailers, and staging areas.
d. Temporary facilities.
e. Temporary utilities and limitations on utility use (where applicable).
f. Utility company coordination (if not done as a separate meeting).
g. Access to Site, access roads, and parking for construction vehicles.

h. Traffic controls.
i. Temporary controls:
    1) Erosion and sediment control; storm water pollution prevention plans.
    2) Dust control and air pollution control (including emissions control).
    3) Water control (storm water, surface water, groundwater).
    4) Water pollution control; spill prevention control and countermeasures plan.
    5) Solid waste control.
    6) Pest control.
    7) Other temporary controls.
j. Security; temporary security fencing (where required).
k. Storage of materials and equipment to be incorporated into the Work.
l. Protection of the Work and property; protective barriers.
m. Field engineering:
    1) Reference points and benchmarks.
    2) Surveys and layouts.
    3) Professional services for Contractor's means and methods (not delegated design).
    4) Contractor's site superintendent's daily records and submittal requirements.
n. Site maintenance during the Project:
    1) Progress cleaning; removal of trash and debris.
    2) Maintenance and cleaning of existing access roads and parking areas.
o. Restoration.

4. Next meeting.
5. Site visit, as necessary.

E. The Engineer will compile meeting minutes from the transcribed record of the meeting and electronically distribute copies to all participants.

F. Pre-Construction Conference Submittals:

1. The names and telephone numbers of Contractor's Superintendent and Office Manager.
2. List of personnel authorized to sign change orders and receive progress payments.
3. The name, address and telephone numbers of two or more persons employed by the Contractor who can be reached at any time of the day or night to handle emergency matters.
4. A list of all subcontractors that will work on the project, a description of work they will perform, and a contact list for each subcontractor with phone numbers and address.
5. A list of materials suppliers for major equipment.
6. A draft proposed Construction Schedule.
7. Material Safety Data Sheets for all hazardous chemical products to be used by the Contractor on this project.
8. Temporary Erosion and Sediment Controls Plan.
9. Traffic Control Plan.

1.3 PROGRESS MEETINGS

A. Bi-Weekly progress meetings will be held a location determined by the Engineer, unless otherwise arranged.

B. Attendees will include the City, Engineer, Contractor, subcontractors, and suppliers' representatives as may be needed, other Contractors working at the site, and other interested or affected parties.

C. Preliminary Agenda: Be prepared to discuss in detail the topics indicated below. Revised agenda, if any, will be furnished to Contractor prior to associated progress meeting(s). Progress meeting agenda may be modified by Engineer during the Project as necessary.

1. Review, comment, and amendment (if necessary) of minutes of previous progress meeting.
2. Review of progress since the previous progress meeting.
3. Planned progress through next progress meeting.
4. Review of Progress Schedule:
    a. Review of the Contract Times; Contractor's ability to comply with Contract Times.
    b. Identification of critical path activities.
    c. Schedules for fabrication and delivery of materials and equipment.
    d. Corrective measures, if necessary, including recovery schedule(s).
5. Submittals:
    a. Review status of critical Submittals.
    b. Review revisions to Schedule of Submittals.
6. Contract Modifications:
    a. Requests for interpretation.
    b. Written clarifications.
    c. Field Orders.
    d. Proposal Requests.
    e. Change Proposals.
    f. Work Change Directives.
    g. Change Orders.
    h. Claims.
7. Applications for progress payments:
    a. Status and deadline for submittal.
    b. Stored materials and equipment; observation by Engineer or RPR; documents required.
    c. Set-offs to which City is entitled (as applicable).
    d. Other matters related to progress payments.
8. Problems, conflicts, and observations.
9. Quality standards, testing, and inspections.
10. Coordination between Project participants.
11. Site management issues, including vehicular access and parking, traffic control, security, status of temporary controls and temporary utilities, site maintenance and cleaning, and other Site matters.
12. Safety and protection.
13. Permits.
14. Construction photographic documentation.
15. Record documents status.
16. Completion matters (as appropriate):
    a. Status of checkout, startup, field quality control activities.
    b. Status of training of facility O&M personnel and O&M manuals.
    c. Partial utilization; inspection for Substantial Completion.
    d. Punch list status (as applicable).
    e. Other closeout matters (if any).
17. Other business.

D. Bring a three-week look ahead schedule to each meeting, including the following items:

1. Work completed last week.

2. Work anticipated for the next two weeks ("Look Ahead").
3. Subcontractors on site the prior week.
4. Subcontractors scheduled on site for the next two weeks.
5. Contract document deficiencies or questions noted during prior week.
6. Anything that could impede the progress of the work or affect the critical path on the project schedule.
7. Corrective measures and procedures planned to regain planned schedule, cost or quality assurance, if necessary.
8. Report of any accidents, and any site safety issues that need to be addressed.

E. Other Agenda items to be discussed:

1. Review and revise as necessary and approve minutes of previous meetings.
2. Status of submittals of equipment and shop drawings.
3. Identify problems that impede planned progress.
4. Other current business.

F. Revision of Minutes:

1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
3. Challenge to minutes shall be settled as priority item of "old business" at the next regularly scheduled meeting.

G. Minutes of Meeting:

1. The Engineer will compile minutes of each project meeting and will furnish electronic copies to the Contractor.

1.4 OTHER MEETINGS

A. Other meetings will be required to facilitate progress of the Work. These include, but are not limited to the following:

1. Pre-Installation Conferences:
   a. Coordinate and schedule with Engineer for each material, product or system specified.
      1) Conferences to be held prior to initiating installation, but not more than two weeks before scheduled initiation of installation.
      2) Conferences may be combined if installation schedule of multiple components occurs within the same two-week interval.
      3) Review manufacturers recommendations and Contract Documents Specification Sections.
2. Facility Startup Planning and Coordination Meeting. See Section 01 75 00.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

FSECTION 01 31 26
ELECTRONIC COMMUNICATION PROTOCOLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedures with which Users will comply regarding transmission or exchange of Electronic Documents for the Project.

B. Related Requirements:

1. Refer to the General Conditions, as may be modified by the Supplementary Conditions, regarding transmitting Electronic Documents by Electronic Means.
2. In addition to the requirements of this Specifications Section, comply with the requirements for Electronic Documents in the following Specifications:
   a. Section 01 32 16 – Small Construction Progress Schedule.
   b. Section 01 33 00 - Submittals.
   c. Section 01 78 39 - Project Record Documents.

1.2 DEFINITIONS

A. The following terms are defined for use in this Specifications Section and are indicated herein using initial capital letters. The terms have the associated meaning regardless of whether indicated in singular or plural.

1. Electronic Documents Protocol (abbreviated as “EDP”): Procedures and requirements set forth in this Specifications Section for the exchange of Electronic Documents by Electronic Means.
2. Project Website: An internet-based software platform, such as a website or other project management information system (PMIS) designated by Contract or mutual consent of Users as the means of exchanging Electronic Documents during the Project.
3. System Infrastructure: Hardware, operating system(s) software, internet access, e-mail service and software, security software, and large-file transfer functions.
4. Users: City, Contractor, Engineer, and others exchanging Electronic Documents on the Project in accordance with the EDP.
5. Electronic Document—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
6. Electronic Means—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow:
   a. The transmission or communication of Electronic Documents;
   b. The documentation of transmissions, including sending and receipt;
   c. Printing of the transmitted Electronic Document by therecipient;
   d. The storage and archiving of the Electronic Document by sender and recipient; and
   e. The use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook/Meta, Twitter/X, Instagram, or similar social media services for transmission of Electronic Documents.

1.3 ADMINISTRATIVE REQUIREMENTS.

A. Coordination:

1. Contractor shall require all Subcontractors and Suppliers to comply with the EDP established in the Contract Documents.

1.4 GENERAL PROVISIONS OF ELECTRONIC DOCUMENT PROTOCOL

A. EDP – General:

1. To the fullest extent practical, Users agree to and will transmit and accept Electronic Documents transmitted by Electronic Means in accordance with the requirements of this Specifications Section. Use of the Electronic Documents and any information contained therein is subject to requirements of this Specifications Section and other provisions of the Contract Documents governing transmittal of Electronic Documents.
2. Content of Electronic Documents will be the responsibility of transmitting User.
3. Unless otherwise provided in: (1) the EDP, (2) elsewhere in the Contract Documents, or (3) or other agreement between two or more Users governing use of Electronic Documents, Electronic Documents exchanged in accordance with the Contract Documents may be used in the same manner as paper or other printed versions of the same documents exchanged using other than Electronic Means, subject to the same governing requirements, limitations, and restrictions set forth in the Contract Documents.
4. Except as otherwise explicitly indicated in the EDP, the terms of this EDP will be incorporated into any other agreement or subcontract between a party and a third party for a portion of the Work or Project-related services, where such third party is, either directly or indirectly, required to exchange Electronic Documents with City, Contractor, or Engineer. Nothing in this EDP modifies the requirements of the Contract Documents regarding communications between and among City, Contractor, and Engineer Subcontractors, Suppliers, consultants, and others for which each is responsible.
5. When transmitting Electronic Documents, transmitting User makes no representations regarding long-term compatibility, usability, or readability of the items resulting from the receiving User's use of software applications or System Infrastructure differing from those established in this EDP.
6. This EDP does not negate or mitigate any obligation: (1) in the Contract Documents to create, provide, or maintain an original paper record version of Drawings and Specifications, signed and sealed in accordance with Laws or Regulations; (2) to comply with Laws and Regulations governing signing and sealing of design documents or signing and electronic transmission of other documents; or (3) to comply with notice requirements of the General Conditions (as may be modified by the Supplementary Conditions).
7. Modifications to EDP:
    a. When modifications to the EDP are necessary to address issues affecting System Infrastructure, Users shall cooperatively resolve the issues.
    b. If resolution within a reasonable time is not achieved, City is empowered to require reasonable and necessary changes to the EDP consistent with the original intent of the EDP.
    c. If such changes result in additional cost or delay to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in the Contract Price, Contract Times, or both in accordance with the Contract Documents.

B. System Infrastructure and Systems for Exchanging Electronic Document:

1. Each User will provide System Infrastructure (as defined in this EDP) at its own cost and sufficient for complying with EDP requirements. Except for minimum standards set forth in this EDP, it is the obligation of each User to determine, for itself, such User's own System Infrastructure.
    a. Maximum size of e-mail file attachment under this EDP is 10megabytes (MB). Attachments larger than the maximum size indicated in this paragraph shall be exchanged via secure electronic transfer using method mutually acceptable to City, Engineer, and Contractor.
    b. Each entity transmitting or receiving Electronic Documents has full responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, and otherwise enabling its System Infrastructure for use in accordance with this EDP.

c. Each User will provide its own printing facilities and will be responsible for its own costs of printing Electronic Documents.

2. Each User is responsible for its own system operations, security, back-up, archiving, audits, and other technology and resources for operations of its System Infrastructure during the Project, including coordination with the User's individual(s) or subcontractor(s) responsible for managing its System Infrastructure and capable of addressing communications and other technology issues affecting exchange of Electronic Documents.

3. Security:

   a. Each User will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems to protect against threats including software viruses and other malicious software including worms, trojans, adware; data breaches; loss of confidentiality; and other threats in transmission to, or storage of, Electronic Documents from other Users, including transmission of Electronic Documents by physical media including flash drives/thumb drives, hard drives, compact discs (CD), digital video discs (DVD), and other portable devices, whether connected physically or wirelessly.

   b. To the extent that a User maintains and operates such security software and appropriate System Infrastructure, such User will not be liable to other Users participating in the Project for breach of system security.

4. Archiving and Electronic Document Backup:

   a. Each User is responsible for its own back-up and archive of Electronic Documents and data transmitted and received during the Project, unless this EDP establishes a Project Electronic Document archive, either as a mandatory Project Website or other communications protocol, upon which Users may rely for Electronic Document archiving for the duration of the Project Website or archiving system established in this EDP.

   b. Each User is solely responsible for its own post-Project back-up and archive of Electronic Documents after the Project is complete or after termination of the Project Website or other Project archive (as applicable), for the longer of: (1) required by the Contract Documents, (2) required by Laws and Regulations, and (3) as each User deems necessary for its purposes.

5. Receipt of Damaged, Incomplete, or Corrupt Electronic Documents: When a receiving User receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving User will advise the transmitting User of the incomplete transmission and transmitting User will retransmit the Electronic Document.

6. Completion of Transmittals: Users will bring non-conforming Electronic Documents into compliance with the EDP. Users will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the transfer of the Electronic Documents.

7. Principal means of exchanging Electronic Documents will be e-mail and files attached to e-mail, in accordance with the EDP.

C. General Requirements and Limitations for Software for Electronic Document Exchange:

1. Software and file formats for exchange of Electronic Documents shall be as indicated in Article 1.5 of this Specifications Section.

2. Software Versions:

   a. Each User will acquire the software and associated licenses necessary to create, transmit, receive, read, and us Electronic Documents for the Project, using the software and file formats indicate in Article 1.5 of this Specifications Section.

   b. Prior to using any updated version of the software required in the EDP for Electronic Document(s) transmitted to other User(s), the originating User will first notify and either (1) receive concurrence from receiving User(s) for use of the updated version, or (2) adjust its transmission to comply with the EDP.

3. Preservation of Intellectual Property and Confidentiality of Electronic Documents:

a. Users agree to not intentionally edit, reverse-engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes Electronic Documents, and information and data contained therein, transmitted in a file format, including portable document format (PDF), intended by transmitting User to not be modified, unless the receiving User (1) obtains permission from owner of the Electronic Document and intellectual property contained therein, or (2) is expressly allowed by the EDP to edit or modify the Electronic Document.

b. Where modifying, editing, decryption, or reverse-engineering is allowed by the EDP, such use is conferred only for the Project.

c. The EDP does not transfer any ownership or rights of any sort regarding use outside of the Project of Electronic Documents.

d. Users shall not cite or quote excerpts of Electronic Documents for purposes outside of the Project unless required to do so by Laws and Regulations.

D. Contractor's Requests for Electronic Documents in Other Formats:

1. Release of Electronic Documents in format(s) other than those indicated in in Article 1.5 of this Specifications Section and elsewhere in the Contract Documents will be at the discretion of City and subject to terms and conditions required by the owner of such files and documents, and the provisions indicated below.

2. To extent determined by City, in its sole discretion, to be appropriate, release of Electronic Documents in alternative format(s) requested by Contractor ("Request") are subject to provisions of City's response to the Request and to the following:

a. Contractor's Request shall be in writing. City and others, as appropriate, will consider and respond to Request promptly, but neither City nor Engineer will be responsible for any time or cost impacts on Contractor associated with timing of the Request, or with City's decision associated therewith.

b. When Engineer is the owner of the Electronic Documents requested by Contractor in native format, prior to Engineer transmitting such Electronic Documents to Contractor, Contractor shall sign and deliver to Engineer, without modifying or amending, Engineer's "Electronic Media Release" agreement.

c. Content included in Electronic Documents created by Engineer and furnished in response to the Request was prepared by Engineer as an internal working document for Engineer's purposes solely and, when provided to Contractor, is on an "as-is" basis without warranties of any kind, including, but not limited to any implied warranties of fitness for purpose. Contractor acknowledges that content of Electronic Documents furnished in response to the Request may not be suitable for Contractor's purpose(s), or may require substantial modification and independent verification by Contractor. Content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other shown or indicated information that may affect subsequent use by Contractor or others for whom Contractor is responsible.

d. Electronic Documents containing text, graphics, metadata, or other types of data furnished by Engineer in response to the Request are only for Contractor's convenience and any and all conclusions or information obtained or derived from such Electronic Documents will be at Contractor's sole risk and expense. Contractor waives any and all claims against Engineer, City, or both arising from Contractor's use of Electronic Documents furnished in response to the Request.

e. Contractor shall indemnify and hold harmless City, Engineer, and their respective consultants and subconsultants from any and all claims, damages, losses, and expenses, including attorneys' fees and defense costs, fees and costs of engineers, architects, geologists, accountants, and other professionals, and any and all other costs, direct and indirect, resulting from Contractor's use, adaptation, or distribution of Electronic Document(s) furnished in response to the Request.

f. Contractor shall not sell, copy, transfer, forward, give away or otherwise distribute the Electronic Documents (in source format or modified file format) to any third party

without direct written authorization of Engineer or other entity that owns the Electronic document(s), unless such distribution is specifically indicated in the Request and is limited to Subcontractors and Suppliers. Contractor warrants that subsequent use by Subcontractors and Suppliers complies with terms and conditions of the Contract Documents, City's response to the Request, and release agreement(s) (if any) by owner of the Electronic Documents (including Engineer, where applicable).

3. When the Request is for Electronic Documents in a format not other than that indicated in the Contract Documents, and City (and others, as applicable) decide to comply with the Request, and when the requested Electronic Documents are not easily available in the format(s) requested, Contractor shall reimburse City for costs incurred by City, either directly or indirectly, to furnish Electronic Documents in accordance with the Request. In compensation, City may retain such amount(s) as set-off(s) under the Contract Documents.

1.5 EXCHANGE OF ELECTRONIC DOCUMENTS

A. Comply with the Electronic Document formats, transmission methods, and permitted uses set forth in Table 01 31 26-A, Exchange of Electronic Documents, below, when transmitting or using Electronic Documents on the Project. Where a row in the table has no indicated means of transmitting Electronic Documents, use for such documents only paper copies transmitted to the receiving party via appropriate delivery method.

TABLE 01 31 26-A – EXCHANGE OF ELECTRONIC DOCUMENTS

Electronic Document Type	Format	Transmitting User	Transmission Method	Receiving User	Allowed Uses	Notes
1.5.A.1. Project communications						
General communications & correspondence	EM, PDF	O, E, C	EM, EMA	O, E, C	R	
Meeting notices and agendas	EM, PDF	E	EM, EMA	O, C	R	
Meeting minutes	PDF	E	EM, EMA	O, C	R	
1.5.A.2. Contractor's Submittals to Engineer						
Shop Drawings	PDF	C	EMA	E	M (1)	(1)
Product data Submittals, delegated design Submittals, and other action Submittals (except Samples)	PDF	C	EMA	E	M (1)	(1)
Informational and closeout Submittals:	PDF	C	EMA	E	M (1)	(1) (6)
Documentation of delivery of maintenance materials submittals	PDF	C	EMA	E	M (1)	
1.5.A.3. Engineer's return of reviewed Submittals to Contractor						
Shop Drawings	PDF	E	EMA	O., C	R	
Product data Submittals, delegated design Submittals, and other action Submittals	PDF	E	EMA	O., C	R	
Informational and closeout Submittals:	PDF	E	EMA	O., C	R	(6)
Documentation of delivery of maintenance materials submittals	PDF	E	EMA	O. C	R	
1.5.A.4. Contract Modifications Documents						
Requests for interpretation to Engineer	PDF	C., O	EMA	E	M (1)	(1)
Engineer's interpretations (RFI responses)	PDF	E	EMA	C, O	R	

Electronic Document Type	Format	Transmitting User	Transmission Method	Receiving User	Allowed Uses	Notes
Engineer's clarifications to Contractor	EM, PDF	E	EM, EMA	C, O	R	
Engineer's issuance of Field Orders	PDF	E	EMA	C, O	R	
Proposal Requests	PDF	E, O	EMA	C	R	
Change Proposals – submitted to Engineer	PDF	C	EMA	O, E	S	
Change Proposals – Engineer's response	PDF	E	EMA	C. O		
Work Change Directives (for Contractor signature)	PDF	E	EMA	C	R	(2)
Change Orders (for Contractor signature)	PDF	E	EMA	C	R	(2)
1.5.A.5. Applications for Payment						(3)
1.5.A.6. Claims and other notices						(4)
1.5.A.7. Closeout Documents						
Record drawings	DWG and PDF	C	EMA	E, O	M (5)	(5)
Other record documents	PDF	C	EMA	E. O	M (5)	(5)
Contract closeout documents						

1. Key to Table 01 31 26-A:
   a. Data Format:
      1) EM: .msg, .htm, .txt, .rtf, e-mail text.
      2) W: .docx, Microsoft Word 2013 or later.
      3) EX: .xlsx, Microsoft Excel 2013 or later.
      4) PDF: .pdf. portable document format.
      5) DWG: .dwg. Autodesk AutoCAD 2014 drawing.
   b. Transmitting User:
      1) O: Owner (City).
      2) C: Contractor.
      3) E: Engineer.
   c. Transmission Method:
      1) EM: Via e-mail.
      2) EMA: Attachment to e-mail transmission.
      3) PORT: Delivered via portable media such as flash drive/thumb drive, CD, or DVD
      4) PW: Posted to Project Website.
      5) FTP: FTP transfer to receiving FTP server.
   d. Receiving User:
      1) O: Owner (City).
      2) C: Contractor.
      3) E: Engineer.
   e. Permitted Uses:
      1) S: Store and view only.
      2) R: Reproduce and distribute.

3) I: Integrate (incorporate additional electronic data without modifying data received)
4) M: Modify as required to fulfill obligations for the Project.

f. Notes:
1) Modifications by Engineer to Contractor's Submittals and requests for interpretations are limited to printing, marking-up, and adding comment sheets.
2) May be distributed only to affected Subcontractors and Suppliers. Print, sign document, and return signed paper originals to Engineer.
3) Submit printed Applications for Payment with original ("wet") signatures.
4) Submit notices, including Claims, in accordance with the notice provisions of the General Conditions, as may be modified by the Supplementary Conditions.
5) Submit record drawings in native CAD format indicated when Contractor has signed Engineer's standard agreement for release of electronic media. In addition, always submit record drawings as PDF files. Comply with Contract Documents requirements for Project record documents.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for Contractor's construction Progress Schedules and related Submittals, including:
   a. Administrative requirements regarding progress Schedules.
   b. Qualifications of Progress Schedule preparer and related personnel.
   c. Submittals of Progress Schedules and associated schedule-related Submittals.
   d. Initial Progress Schedules.
   e. Look-ahead schedules.
   f. Progress Schedule updates.
   g. Time impact analyses.
   h. Recovery schedules.

B. Scope:

1. Contractor shall prepare and submit to Engineer required Progress Schedules and related Submittals, as required by this Section and elsewhere in the Contract Documents. Maintain and update Progress Schedules and related Submittals throughout the Project.
2. City, facility manager (if other than City), Engineer, and others involved with the Project have the right to rely on accuracy of Contractor-prepared Progress Schedule.
3. Engineer's review or acceptance of the Progress Schedule or related Submittals, and Engineer's comments on and expressed opinions concerning activities in the Progress Schedule and related Submittals, and progress of the Work, does not control Contractor's independent judgment concerning construction means, methods, techniques, sequences and procedures, unless the associated means, method, technique, sequence, or procedure is required by the Contract Documents. Contractor is solely responsible for complying with the Contract Times.

C. Related Requirements: Include, but are not necessarily limited to:

1. Section 01 11 00 - Summary of Work.
2. Section 01 31 19 - Project Meetings.

1.2 REFERENCES.

A. Defined Terms and Terminology:

1. Defined terms, indicated with initial capital letters, are indicated in the General Conditions, as may be modified by the Supplementary Conditions.
2. Terminology: The following are not defined terms and are not indicated with initial capital letters but, when used in this Section, have the meaning indicated below, whether applied to the singular or plural thereof.
   a. "Activity" is an element of the Work that has the following specific characteristics: consumes time, requires resources, has a definable start and finish, is assignable, and is measurable.
   b. "Baseline Progress Schedule" means, in addition to the General Conditions' definition of "Progress Schedule", the version of the Progress Schedule (for the entire Project) initially accepted by the Engineer. In the event of subsequent modifications to the Project, Contractor and Engineer may mutually agree that a subsequent revision of the Progress Schedule constitutes a new baseline Progress Schedule that supersedes the prior baseline Progress Schedule.

c. “Constraint” means an imposed date on the Progress Schedule or an imposed time between activities. The Contract Times are constraints.

d. “CPM Progress Schedule” means, in addition to the General Conditions’ definition of “Progress Schedule”, a computerized Progress Schedule in critical path method (CPM) format, for the entire Work, indicating interrelationships between elements of the Work; indicates sequences, dates, and durations for Work performed to date; indicates sequences, dates, and duration for incomplete Work yet to be performed; indicates constraints; and indicates the critical path for the Work.

e. “Critical path” is the continuous chain of activities, from start to completion of the Work, with the longest duration for completion within the Contract Times.

f. “Early finish” means the earliest date an activity can finish according to the assigned relationships among the activities in the Progress Schedule.

g. “Early start” means the earliest possible date an activity can start according to the assigned relationships among activities in the Progress Schedule.

h. “Float” means the time difference between the calculated duration of an activity chain on the Progress Schedule and the critical path.

i. “Late finish” means the latest date an activity on the Progress Schedule can finish without extending the Contract Times.

j. “Late start” means the latest date an activity on the Progress Schedule can start without extending the Contract Times.

k. “Schedule date” (and similar terms, whether used in this Section or Project communications related to Progress Schedules) mean the “early start” and “early finish” date for the associated activity. “Late start” and “late finish” dates are for determining float and do not represent the schedule dates.

l. “Total float” means the total number of days an activity (or chain of activities) on the Progress Schedule can be delayed without affecting the Contract Times.

m. “Work areas” and “work system” means a logical breakdown of the Work elements or a group of activities which, when collectively assembled, are readily identifiable on the Project (for example: yard piping, a structure or building, a treatment process, or other logical grouping).

1.3 ADMINISTRATIVE REQUIREMENTS

A. General Provisions on Progress Schedules:

1. This Section augments requirements for the Progress Schedule, and Contractor’s control of the Work, indicated in the General Conditions, as may be augmented by the Supplementary Conditions.

B. Use of Float:

1. Float belongs to the Project and may be used by Contractor or City to accommodate changes in the Work, or to mitigate the effect of events delaying the Work or compliance with the Contract Times.
2. Changes or delays that influence activities that have float and do not extend the critical path do not justify changes in the Contract Times.
3. Float Suppression: Pursuant to float sharing requirements of this Section, use of float suppression techniques in Progress Schedules, such as preferential sequencing logic, special lead/lag logic restraints, and extended activity durations are unacceptable.

C. Factors Affecting the Progress Schedule:

1. In preparing and updating the Progress Schedule, take into consideration: preparing and signing subcontracts and purchase orders, complying with Submittal requirements and Submittal review times, fabricating materials and equipment, source quality control (including required shop tests and inspections), shipping and deliveries, field quality control (including required field tests and inspections at the Site), Work by Subcontractors, coordination with others (such as other contractors including those indicated in Section 01 11 00 – Summary of Work, utility owners, and owners of transportation facilities),

compliance with Laws and Regulations and permits, availability of construction equipment and machinery, abilities of workers, weather conditions, condition of the Site, seasonal restrictions, restrictions in operations at the Site and coordination with City's (or facility manager's) operations, training of facility operation and maintenance personnel, checkout, startup, adjusting and balancing, and other factors that have the potential to affect completion of the Work within the Contract Times.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Progress Schedule Preparer.
    a. Contractor shall retain services of a scheduling consultant to, or shall self-perform, preparation and updating of the Progress Schedule using qualified personnel experienced in: (1) construction scheduling, (2) the scheduling software required for the Project, and (3) serving as Progress Schedule preparer on construction projects of similar type, size, and complexity as the Project.
    b. Progress Schedule preparer shall have not less than two years' experience using the required schedule software on construction projects of similar type, size, and complexity as the Project.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Planned Work Schedule:
    a. Submit initial and updated (as necessary) planned work schedule, in accordance with this Section's "initial Progress Schedule" Article.
2. Progress Schedule:
    a. Acceptable Progress Schedule ("baseline Progress Schedule").
3. Look-Ahead Schedules:
    a. Submit 3-week look-ahead schedule at each construction progress meeting, in accordance with this Section's "Look-Ahead Schedules" Article.
4. Progress Schedule Updates:
    a. Progress Schedule updates shall comply with requirements of this Section, and shall include updated Progress Schedule and associated, required, schedule-related Submittals.
    b. Submit updated Progress Schedule prior to each associated construction progress meeting. When a Progress Schedule remains unchanged from one construction progress meeting to the next, submit written statement expressly so stating. In addition to monthly Progress Schedule update Submittals, also bring to construction progress meetings the number of paper copies of the updated Progress Schedule indicated in Section 01 31 19 - Project Meetings.
5. Time Impact Analyses: Submit in accordance with this Section.
6. Recovery Schedules: Submit in accordance with this Section.

1.6 INITIAL PROGRESS SCHEDULE

A. Applicability of this Article:

1. This Article addresses the initial Progress Schedules and selected, related Submittals required at the outset of the Project's construction phase, through Engineer's acceptance of the Progress Schedule and its related Submittals.
2. Subsequent Progress Schedule Submittals, including Progress Schedule updates, recovery schedules, and other schedule-related Submittals, shall comply with software, type, organization, content, and similar requirements of this Article.

B. Type and Organization of Progress Schedules:

1. Prepare Progress Schedules using Microsoft Project or equal as approved by the Engineer.

2. Sheet Size: 22 inches by 34 inches, unless otherwise accepted by Engineer.
3. Time Scale: Indicate first date of each work week.
4. Activity Assignments and Designations:
    a. Limit activities, where possible, excluding fabrication of materials and equipment, to durations not longer than 10 days. Activities shall be definable and measurable. For example, an activity described only as, “Concrete,”, will likely be unacceptable.
    b. Assign to each activity an appropriate, unique numerical designation and description.
    c. Numerical designation shall incorporate the associated Specifications section number.
    d. Activity description shall include sufficient detail to clearly communicate the intended activity. Descriptions shall include identifiers for physical locations of work area or work system, such as (where appropriate): column lines, stationing (for linear projects), and elevations. Indicate unique description for each activity.
    e. Group deliveries of materials and equipment into a separate sub-schedule that is part of the Progress Schedule.
    f. Group construction into work area sub-schedules (that are part of the Progress Schedule) by activity.
    g. Clearly indicate, as activities separate from installation, necessary and required curing periods.
5. Indicate interfaces and dependencies with preceding, concurrent, and follow-on activities, including those associated with the Work, other contractors at the Site, City and facility manager, City’s consultants (including Engineer), authorities having jurisdiction, and others as appropriate. Clearly indicate activities not under Contractor’s control.
6. Progress Schedules shall be CPM Progress Schedules.
7. Indicate on the separate Schedule of Submittals dates for submitting and reviewing Shop Drawings, product data Submittals, Samples, and other required Submittals. Coordinate Progress Schedule with the Schedule of Submittals.
8. Clearly indicate the critical path on the Progress Schedule.

C. Planned Work Schedule:

1. Within 21 days of the Effective Date of the Contract, indicate to Engineer the work days and hours proposed by Contractor. Also indicate planned non-work days, such as Contractor’s holidays, weekends, and the like.
2. Enforce Subcontractors’ and Suppliers’ (when at the Site) compliance with Contractor’s work schedule submitted to Engineer.
3. In the event of changes, submit to Engineer revised work schedule. Furnish such Submittal not less than three days prior to changing Contractor’s work schedule, except in event of unanticipated emergency.

D. Preliminary Progress Schedule:

1. Within 10 days after the Contract Times commence running, Contractor shall submit to Engineer the preliminary Progress Schedule covering the entire Project, with associated schedule-related Submittals required in this Section’s “Submittals” Article.
2. Submit preliminary Progress Schedule in accordance with Section 01 31 26 - Electronic Communication Protocols and Section 01 33 00 - Submittal Procedures. Also submit preliminary Progress Schedule in its native (executable) format generated by the scheduling software, transmitted in accordance with Section 01 31 26 - Electronic Communication Protocols.
3. Engineer will perform timely review of the preliminary Progress Schedule.

E. Initial Acceptance of Progress Schedule:

1. Not less than 10 days before submission of the first Application for Payment, a scheduling conference attended by Contractor, Progress Schedule preparer, Engineer, and others as appropriate will be held at the Site to review for acceptability to Engineer the preliminary Progress Schedule and associated schedule-related Submittals. Following the scheduling

conference, Contractor shall have five days to make corrections and adjustments and to complete and resubmit the Progress Schedule and associated schedule-related Submittals. Contractor will not be eligible for first progress payment until acceptable Progress Schedule and associated schedule-related Submittals are submitted to Engineer and are acceptable to Engineer.

2. Submit acceptable Progress Schedule, together with associated schedule-related Submittals in accordance with this Section's "Submittals" Article, Section 01 31 26 - Electronic Communication Protocols, and Section 01 33 00 - Submittal Procedures. Also submit acceptable form of Progress Schedule in its native (executable) format generated by the scheduling software, transmitted in accordance with Section 01 31 26 - Electronic Communication Protocols.
3. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times, in accordance with the Contract Documents.
4. Initially-accepted Progress Schedule shall be identified as the baseline Progress Schedule.

1.7 PLANNED COMPLETION DIFFERENT FROM THE CONTRACT TIMES:

A. If the Progress Schedule accepted by Engineer indicates completion date(s) different than the Contract Times, the Contract Times are not thereby changed.

1. Where the Progress Schedule accepted by Engineer indicates date(s) by which the Work, or designated portion thereof, will (a) achieve a Contractually stipulated Milestone, or (b) be substantially complete, or (c) all the Work will be complete and ready for final payment, earlier than the Contract Times ("early completion date"), Contractor shall, not less than 120 days prior to the associated Contract Time, prepare and submit a Change Proposal setting forth Contractor's request to modify the Contract Times to an earlier date, which may or may not be the same as the scheduled early completion date. The Contract Times can be modified only via a Change Order.
2. In the event the Progress Schedule accepted by Engineer indicates one or more early completion dates and the Contract Times have not been reduced, City may, at City's option, use available float without City being liable for Contractor's costs to remain onsite, mobilized, and working (whether on the original scope of the Work or for modified Work) beyond the scheduled early completion date(s), as long as the Work will be completed within the Contract Times.
3. When the Work will not be completed within the Contract Times, the Contract Documents' provisions concerning delays and changes in the Contract Times govern.

1.8 LOOK-AHEAD SCHEDULES

A. Look-Ahead Schedules – General:

1. Look-ahead schedules are short-duration, often more-detailed, time-based schedules for the Work to be performed during the coming month or other required span of the look-ahead schedule.
2. Purpose of look-ahead schedules is to present, for Project stakeholders, including City, facility manager (if other than City), Engineer, City-hired testing and inspection entities, other contractors working at or adjacent to the Site, utility owners, transportation facility owners, and others as necessary, Contractor's detailed, time-based plan for performing the Work during the period covered by the time span of the look-ahead schedule.
3. This Section's "Submittals" Article indicates the required span and frequency of look-ahead schedules.
4. Each look-ahead schedule shall be fully coordinated and consistent with the current Progress Schedule update.
5. Submit look-ahead schedules concurrent with construction progress meetings, in accordance with Section 01 31 26 - Electronic Communication Protocols, and Section 01 33 00 – Submittal Procedures. Also submit look-ahead schedules in native (executable) format, in accordance with Section 01 31 26 - Electronic Communication Protocols.

6. As handouts, bring to each construction progress meeting the quantity of paper copies of the new look-ahead schedule indicated in Section 01 31 19 - Project Meetings. If quantity is not indicated in Section 01 31 19 - Project Meetings, furnish quantity equal to typical number of attendees of progress meetings.

B. Organization and Content of Look-Ahead Schedules:

1. Look-ahead schedules shall be prepared from the current Progress Schedule update, of the same type, using the same software, content, and organization required in this Section for initial Progress Schedules.
2. Activity designations on look-ahead schedules shall incorporate the associated activity designations from the Progress Schedule.
3. Sheet Size: Format look-ahead schedules to sheet size of 11 inches by 17 inches, unless other sheet size is acceptable to Engineer.
4. Look-ahead schedules should generally be more-detailed than the Progress Schedule. Activity durations on look-ahead schedules should not exceed five days.

1.9 PROGRESS SCHEDULE UPDATES

A. Updates – General:

1. Update the Progress Schedule not less-often than once per month. If during progress of the Work events develop that necessitate changes in the initially accepted Progress Schedule (baseline Progress Schedule), identify updated Progress Schedules sequentially as “Progress Schedule Revision “1”, “2”, “3”, and continuing in sequence as required. Number the Progress Schedule submittals in accordance with Section 01 33 00 - Submittal Procedures.
2. Starting with first Progress Schedule update, and continuing with each subsequent update, indicate on the Progress Schedule the actual start and finish dates of each activity that is completed or is currently underway. Inaccurate representation of completed or in-progress activities will be grounds for Engineer’s non-acceptance of the Progress Schedule update.
3. Progress Schedule update shall be based on retained logic. Progress override logic is not allowed.
4. Required scheduling software, and schedule organization, format, and content for updated Progress Schedules are identical to that required in this Section for initial Progress Schedules.
5. Transmittal Letter:
    a. Furnish each Progress Schedule update Submittal with transmittal letter expressly indicating the following:
        1) List of activities and dates changed since the previous Progress Schedule Submittal.
        2) Clear indication of the activities on the Project’s critical path.
        3) List of Work performed since the previous Progress Schedule Submittal.
        4) Discussion of problems causing delays, anticipated duration of delays, and proposed countermeasures.
    b. Required transmittal letter does not count as contractually-required notice of Change Proposal or Claim, nor any other notice required by the Contract Documents. Separately prepare and transmit such notices in accordance with the Contract Documents.
6. Submit to Engineer updated Progress Schedule, together with associated schedule-related Submittals, in accordance with this Section’s “Submittals” Article, Section 01 31 26 - Electronic Communication Protocols, and Section 01 33 00 - Submittal Procedures. Also submit updated Progress Schedule in its native (executable) format generated by the scheduling software, transmitted in accordance with Section 01 31 26 - Electronic Communication Protocols.

1.10 TIME IMPACT ANALYSIS

A. Time Impact Analyses – General:

1. Prepare and submit time impact analysis when one or more of the following occurs: (a) Change Proposal is prepared; (b) Work Change Directive is issued that will affect the Progress Schedule; or (c) when delays occur.
2. Time impact analysis shall illustrate influence of each Change Order, Work Change Directive, allowance authorization, or delay, as applicable, on Contractor's ability to comply with the Contract Times and Progress Schedule constraints.
3. In performing time impact analysis, use Progress Schedule having revision date closest to and prior to the event giving rise to the delay or other change in the Work.
4. Indicate in time impact analysis activities on the Project's critical path prior to the event giving rise to the delay or other Change in the Work; activities added, extended, or deleted as a result of the delay or change in the Work; and impact of such changes on the Project's critical path activities.
5. Indicate in time impact analysis activities not within Contractor's control.
6. Time impact analysis shall demonstrate the time impact, based on date the Change Order, Work Change Directive, or allowance authorization was given to Contractor or, as applicable, date the delay started to occur; the status of the Work at that time; and activity duration of affected activities. Activity duration used in time impact analysis shall be those included in most recent Progress Schedule update accepted by Engineer, closest to start of the delay or start of the Change Order, Work Change Directive, or allowance authorization as adjusted by mutual, written agreement of the parties and Engineer.
7. Timing of Time Impact Analysis:
    a. Submit time impact analysis with Change Proposal.
    b. When time impact analysis is not part of a Change Proposal, submit each time impact analysis within 15 days after the following, as applicable:
        1) Start of the delay.
        2) After Contractor's receipt of Work Change Directive.
    c. When Contractor does not submit time impact analysis for a specific change or delay, within the specified period for such submittal, such non-submittal will indicate extension of the Contract Times is not needed.

B. Evaluation by Engineer and Acceptance:

1. Engineer's evaluation of each time impact analysis comprised of complete information will be completed in timely manner (in accordance with the Contract Documents) after Engineer's receipt.
2. When time impact analysis is incomplete or otherwise inappropriate, Engineer will furnish comments to Contractor. When time impact analysis is complete and apparently appropriate, its acceptability will be indicated by associated Contract modification or allowance authorization.
3. Changes in the Contract Times will be made only by Change Order.
4. When mutual agreement is reached between the parties on effect of the change or delay in the Project, incorporate into the next Progress Schedule update the associated Progress Schedule revisions illustrating the influence of changes and delays.

1.11 RECOVERY SCHEDULES

A. Recovery Schedules – General:

1. When updated Progress Schedule indicates the ability to comply with the Contract Times falls 10 days or more behind schedule, and there is no excusable delay, Change Order, or Work Change Directive to support an extension of the Contract Times, Contractor shall prepare and submit to Engineer Contractor's recovery schedule.
2. Recovery schedule is a Progress Schedule demonstrating Contractor's plan to accelerate the Work to achieve compliance with the Contract Times. If achieving the Contract Times is

not feasible, Contractor's recovery schedule shall indicate Contractor's plan to recover as much of the lost time as possible to complete the Work as close as possible to the Contract Times.

3. Submit recovery schedule within 10 days after submittal of updated Progress Schedule where need for recovery schedule is indicated.

B. Recovery Schedule Report:

1. With each recovery schedule Submittal, include recovery schedule narrative report, manually prepared by Contractor, on Contractor's company letterhead, indicating name of person responsible for preparing the recovery schedule and report.
2. Recovery schedule report shall verbally indicate Contractor's plan for accelerating the Work and recovering lost time, and shall indicate the total number of days expected to be recovered by Contractor's implementation of the recovery schedule. Clearly indicate how the intended actions will recover lost time.
3. Contractor is fully responsible for complying with the Contract Documents, including the contract Times.

C. Implementation of Recovery Schedule:

1. At no additional cost to City, do one or more of the following, as appropriate: (a) furnish additional labor, (b) provide additional construction equipment and machinery, (c) provide suitable materials to accelerate the Work, (d) employ additional work shifts, (e) expedite procurement of materials and equipment to be incorporated into the Work or otherwise expedite delivery of such items, (f) provide other needed resources, and (g) provide other measures necessary to complete the Work within the Contract Times.
2. Upon acceptance of recovery schedule by Engineer, incorporate recovery schedule into the next Progress Schedule update.

D. Contractor's Failure to Recover Lost Time:

1. Contractor's refusal, failure, or neglect to take appropriate measures to recover lost time, or to submit a recovery schedule, shall constitute reasonable evidence that Contractor is not prosecuting the Work, or designated part of the Work, with diligence to ensure completion in accordance with the Contract Times. Such action or inaction by Contractor shall constitute sufficient basis for City to exercise remedies available to City under the Contract Documents.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Definition of various types of Submittals.
   2. Coordination requirements for Submittals.
   3. General provisions concerning Submittals.
   4. Schedule of Submittals.
   5. Contractor's preparation of Submittals, including:
      a. Numbering.
      b. Marking.
      c. Organization and content.
      d. Proposed "or-equals", substitutes, and deviations from Contract requirements.
      e. Electronic Documents Submittals.
      f. Contractor's review and approval of each Submittal.
      g. Resubmittals.
   6. Contractor's transmittal of Submittals, including transmittal letters, transmittal and delivery method, and delivery of Samples, Closeout Submittals, and Maintenance Materials Submittals.
   7. Engineer's review, including:
      a. Timing.
      b. Meaning of Engineer's Submittal action code (disposition) assigned.
      c. Delivery of Engineer's responses on Submittals.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, tools, services, incidentals, and other effort necessary to furnish Shop Drawings, product data Submittals, Samples, and other Submittals in accordance with the Contract Documents.
   2. This Section's Article, "General Provisions Concerning Submittals" includes a summary of the Contract Documents' locations of Submittals requirements.
   3. Shop Drawings, product data Submittals, Samples, and other Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Engineer's approval or acceptance, as applicable, of a Submittal does not alter or modify the Contract Documents.
   4. Engineer and City have the right to rely on Contractor's representations and certifications made regarding each Submittal.

C. Related Requirements: Include but are not limited to:
   1. Section 01 25 00 - Substitution Procedures.
   2. Section 01 31 26 - Electronic Communication Protocols.
   3. Section 01 32 16 - Construction Progress Schedule.

1.2 REFERENCES

A. References – Introduction:
   1. This Article presents definitions and terminology used in this Section and throughout the Contract Documents.
   2. Applicability of the Term "Submittals": Where reference is made to Shop Drawings, product data Submittals, Samples, or other Submittals in this Section and elsewhere in the Contract Documents, the term "Submittals", as defined in the Contract Documents, is intended. The foregoing applies regardless of whether such term is indicated with an initial capital letter, unless context of the subject provision clearly indicates otherwise.
   3. Types of Submittals:

a. Submittal types are classified as follows: (1) Action Submittals, (2) Informational Submittals, (3) Closeout Submittals, and (4) Maintenance Materials Submittals.
b. Type of each required Submittal is indicated in the associated Specifications section. When Submittal type is not clearly indicated in the associated Specifications section, Submittal will be classified as indicated in this Article. Submit request for interpretation when Contractor is uncertain of required Submittal type.

B. Action Submittals:
1. Action Submittals require an explicit, written approval or other appropriate action by Engineer (or other entity to whom the Submittal is required to be furnished, in accordance with the Contract Documents) before Contractor may release the associated item(s) for raw materials procurement, fabrication, production, and shipping.
2. Unless otherwise indicated in the Contract Documents, Action Submittals include the following:
a. Shop Drawings.
b. Product data.
c. Samples.
d. Testing plans for quality control activities required by the Contract Documents.
e. Delegated Designs: Delegated design professional's "instruments of service" Submittals required by the Contract Documents.
3. General Conditions' requirements for Shop Drawings and Samples hereby apply to all Action Submittals.

C. Informational Submittals:
1. Informational Submittals are so indicated in the Contract Documents. Unless otherwise indicated, Informational Submittals include certifications, evaluation reports, results of source quality control activities, results of field quality control activities, Supplier instructions, reports of Suppliers' visits to the Site, sustainable design Submittals (that are not Closeout Submittals), delegated design Submittals that are not "instruments of service" Submittals, qualifications statements, and others.
2. Informational Submittals, when submitted in accordance with the Contract and indicating full compliance with the Contract Documents, do not require explicit response from Engineer (or other entity to whom the Submittal is to be delivered); Engineer's (or other entity's) acceptance thereof will be indicated in the Engineer's Submittals log. Copy of Engineer's Submittals log is available to Contractor upon Contractor's written request.
3. When Informational Submittal does not indicate full compliance with the Contract Documents, Engineer (or other entity to which Submittal is to be delivered) will indicate the non-compliance in a written response to Contractor.

D. Closeout Submittals:
1. Closeout Submittals are so indicated in the Contract Documents and are, in general, required before the associated Work is completed, unless earlier submittal is required by the Contract Documents.
2. Unless indicated otherwise in the Contract Documents, Closeout Submittals include maintenance contracts, operation and maintenance data, warranties, bonds (other than performance and payment bonds required prior to the start of construction), record documents, sustainable design closeout Submittals, software, keys, and others.
3. Closeout Submittals are processed in the same manner as described above for Informational Submittals.

E. Maintenance Materials Submittals:
1. Maintenance materials include spare parts, extra materials, tools, and similar items required to be furnished in accordance with the Contract Documents.
2. Furnish required physical maintenance materials, delivered to City or facility manager (if other than City), as applicable, at the location(s) indicated in the Contract Documents, for the corresponding required Maintenance Materials Submittals.
3. Maintenance Materials Submittals are documentation of delivery to City's or facility manager, and their acceptance of, required physical maintenance materials.

4. Maintenance Materials Submittals are processed in the same manner as described above for Informational Submittals.

F. Additional Terms:
   1. The following terms have the meanings indicated below, regardless of whether such terms are indicated using initial capital letters, and apply to singular and plural of each:
      a. "Product data" means illustrations, standard schedules, performance charts, Supplier's published instructions, brochures, diagrams, and other information furnished by Contractor to illustrate or describe materials or equipment for some portion of the Work. In general, product data are manufacturers' pre-published information on the items proposed to be incorporated into the Work. Product data includes manufacturer's catalog pages and similar documents with contractor-made markings and indications of proposed products and proposed options.
      b. The term "Shop Drawings", defined in the General Conditions, is supplemented by the following: Shop Drawings include: (1) fabrication and assembly drawings, usually having a title block, or (2) schedules, prepared specifically for the Project. Here, "schedules" means a Project-specific summary of systems and components, such as a schedule of HVAC equipment, schedules of doors and door hardware, or windows, or a schedule of paint systems by room and surface, or other, similar Project information in a tabular format. In contrast, construction Progress Schedules, Schedules of Submittals, and Schedules of Values are not Shop Drawings.
      c. Samples – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
      d. Schedule of Submittals – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.
      e. Shop Drawings – All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
      f. Submittal - A written or graphic document, prepared by or for Contractor, which the contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Furnish Submittals well in advance of need for the associated material or equipment, or procedure (as applicable), in the Work and with ample time necessary for delivery of materials and equipment and to implement procedures following Engineer's approval or acceptance of the associated Submittal.
   2. Work covered by a Submittal will not be included in payments by City until approval or acceptance (as applicable) of related Submittals has been obtained in accordance with the Contract Documents.

1.4 GENERAL PROVISIONS CONCERNING SUBMITTALS

A. Locations of Requirements:

1. Requirements concerning Submittals are generally located as follows:
    a. General Conditions, as may be modified by the Supplementary Conditions, applicable to the Project.
    b. This Section, which presents general requirements for Submittals applicable to the Project.
    c. Other Division 01 Specifications that include general requirements for certain types of Submittals, such as Section 01 31 26 - Electronic Communications Protocols and others.
    d. The "Submittals" Article of the various Specifications sections, which indicates the required Submittals for the associated Work. Furnish all Submittals required by the Contract Documents regardless of whether explicitly indicated in the associated Specifications' "Submittals" Article.

B. This Section augments and supplements the requirements of the General Conditions, as may be modified by the Supplementary Conditions, relative to Submittals.

1.5 SCHEDULE OF SUBMITTALS

A. Informational Submittals: Submit the following:
    1. Schedule of Submittals:
        a. Timing:
            1) Furnish Schedule of Submittals within time frames indicated in the General Conditions, as may be modified by the Supplementary Conditions.
            2) Submit updated Schedule of Submittals with each submittal of the updated Progress Schedule.
        b. Content: In accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent Submittals of the Schedule of Submittals are identical. Identify on Schedule of Submittals all Submittals required in the Contract Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Clearly indicate Submittals that are on the Project's critical path. Indicate the following for each Submittal:
            1) Date by which Submittal will be received by Engineer.
            2) Whether Submittal will be for a substitution or "or-equal".
            3) Date by which Engineer's response is required. Allow not less than 14 days for Engineer's review, starting on Engineer's actual receipt of each Submittal. Allow increased time for large or complex Submittals.
            4) For Submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of others (if any).
        c. Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules in Section 01 32 16 - Small Construction Progress Schedule.
        d. Coordinate Schedule of Submittals with the Progress Schedule.
        e. Schedule of Submittals that is not compatible with the Progress Schedule, or that does not indicate Submittals on the Project's critical path, or that places extraordinary demands on Engineer for time and resources, is unacceptable. Do not include Submittals not required by the Contract Documents.
        f. In preparing Schedule of Submittals:
            1) Considering the nature and complexity of each Submittal, allow sufficient time for reviews and revisions.
            2) Allow reasonable time for: Engineer's review and processing of Submittals, for Submittals to be revised and resubmitted, and for returning Submittals to Contractor.
            3) Identify and accordingly schedule Submittals that are expected to have long anticipated review times.

1.6 PREPARATION OF SUBMITTALS

A. Prior to Submittal Preparation:
   1. The General Conditions, as may be modified by the Supplementary Conditions, address Contractor's responsibility for submitting for City's acceptance identification of Subcontractors and Suppliers. Obtain City's acceptance before entering into subcontracts and purchase orders for the Work.
   2. Comply with the Contract Documents relative to terms and conditions of subcontracts and purchase orders for the Work.
   3. Contractor's responsibilities for the following are set forth in the General Conditions, as may be modified by the Supplementary Conditions, and as may be augmented elsewhere in the Contract Documents:
      a. Obtaining field measurements and dimensions.
      b. Determining and verifying required quantities.
      c. Verifying compatibility of materials.
      d. Apportioning the Work among Subcontractors, Suppliers, and Contractor.
      e. Reconciling required materials, equipment, and other Contract requirements with Contractor's means, methods, techniques, sequences, and procedures of construction and with Contractor's safety and protection programs and precautions incident thereto.
      f. Reviewing applicable provisions of the Contract Documents and obtaining from Engineer necessary interpretations or clarifications.

B. Submittal Identification:
   1. Submittal Number: Shall be a unique number assigned to each individual Submittal. Assign Submittal numbers as follows:
      a. First part of Submittal number shall be the applicable Specifications section number, followed by a hyphen.
      b. Second part of Submittal number shall be a three-digit number (sequentially numbered from 001 through 999) assigned to each separate Submittal furnished under the associated Specifications section.
      c. Example: Submittal number for the third Submittal furnished for Section 10 14 00 - Signage, would be "10 14 00-003".
   2. Review Cycle Number: Each resubmittal of a given Submittal shall be indicated with a lower-case letter designation:
      a. No letter designation for initial (first) submittal of the Submittal number.
      b. "a" shall indicate first resubmittal of the Submittal number.
      c. "b" shall indicate second resubmittal of the Submittal number.
   3. Examples:

Example Description	Submittal Identification	
	Submittal No.	Review Cycle
Initial (first) review cycle of the third Submittal furnished under Section 10 14 00 – Signage	10 14 00-003-	
Second review cycle (first resubmittal) of third Submittal furnished under Section 10 14 00 - Signage	10 14 00-003-	a

C. Marking of Submittals:
   1. Mark on each page of each Submittal and each individual component submitted with Submittal number and applicable Specifications paragraph.
   2. Mark each page of each Submittal with the Submittal page number.
   3. Each Shop Drawing sheet shall have title block with complete identifying information satisfactory to Engineer.
   4. For product data Submittals, operation and maintenance data Submittals, and other Submittals:

a. Mark options to be furnished using broad, dark arrows or "clouds" clearly drawn around the relevant text or diagrams. Do not use highlighter for indicating options and features.
b. Indicate options and features not furnished using clear strikeouts through the text or diagrams.

D. Submittal Organization and Content – General:
1. Page or Sheet Size; Furnish Submittals with one or more of the following page or sheet sizes: (a) 8.5 inches by 11 inches; (b) 11 inches by 17 inches; (c) 22 inches by 34 inches; unless another sheet size is acceptable to Engineer.
2. Language: All parts of each Submittal shall be in the English language.
3. Units of Measurement: Clearly indicate units of measurement on Shop Drawings, product data Submittals, record documentation, and operation and maintenance data Submittals.
4. Organize each Submittal logically to facilitate ease of understanding and review.
5. To the extent practicable, arrange Submittal information in same order as requirements are written in the associated Specifications section.
6. Each Submittal shall cover Work under only one Specifications section.
7. To the extent practicable, package together Submittals for the same Specifications section. Do not furnish required information piecemeal.
8. For large or complex Submittals, include a title page and table of contents.
9. Include appropriately labeled fly sheets to separate distinct parts of each Submittal.
10. Ensure legibility of all pages in each Submittal.
11. Minimize extraneous and unnecessary information in Submittals for materials and equipment. Do not submit information not relevant to the Submittal and associated requirements of the Contract Documents.
12. Contractor's, Subcontractor's, and Supplier's written comments on Shop Drawings and product data diagrams shall be colored green
13. Do not submit under Specifications sections with title that include "Basic Requirements", unless the subject material or equipment is specified, in total, in a Specifications section with the words, "Basic Requirements" in its title.

E. Electronic Documents Submittals:
1. Format: Electronic Documents Submittals shall be "portable document format" (.PDF) files unless expressly required otherwise by applicable provisions of the Contract Documents.
2. Electronic Documents Submittals must be electronically searchable when delivered to Engineer and other recipients.
3. Organization and Content:
a. Each Electronic Documents Submittal shall be one file; do not divide individual Submittals into multiple Electronic Documents files each unless file size will exceed 20 MB.
b. When Submittal is large or contains multiple parts, furnish PDF file with suitably titled electronic bookmark for each section of the Submittal.
c. Content shall be identical to paper or other original Submittal. First page of each Electronic Documents Submittal shall be transmittal letter required in this Section's Paragraph 1.7.A.
4. Quality and Legibility: Electronic Documents Submittal files shall be made from the original and shall be clear and legible. Markings applied by Contractor, Subcontractor, or Supplier shall be clear, distinct, and readily apparent. Electronic Documents file shall be full size of original documents. Properly orient all pages for convenient reading on a computer display; do not furnish pages sideways or upside-down.
5. Provide sufficient internet service, software, and systems for Contractor with capability appropriate for transmitting the necessary files and receiving responses from Engineer or other entities.
6. Check not less than once per day for distribution of Electronic Documents Submittals responses and related Electronic Documents correspondence.

F. Proposed "Or-Equals", Substitutes, and Deviations from Contract Requirements:

1. "Or-Equals":
    a. The meaning of "or-equal" is addressed in Section 01 25 00 - Substitution Procedures.
    b. Contractor's request for approval of "or-equals" is to be presented via the associated Action Submittal(s) and shall include the information required in provisions governing "or-equals".
    c. Expressly and prominently indicate, "Proposed Or-Equal" on the associated Action Submittals when Submittal is for an "or-equal".
    d. Submittals requesting approval of an "or-equal" but not accompanied by the required, supplemental information will be deemed incomplete by Engineer and returned to Contractor without approval.
2. Substitutes:
    a. The meaning of "substitute" is indicated in Section 01 25 00 - Substitution Procedures.
    b. Requests for approval of substitutes shall comply with Section 01 25 00 - Substitution Procedures, and other relevant provisions of the Contract Documents.
    c. Contractor's request for approval of substitute is separate from the associated Action Submittal(s). Action Submittals that request approval of a substitute when a separate, formal substitution request (furnished in accordance with the Contract Documents) was not previously furnished to Engineer, followed by formal approval via an appropriate contract modification (typically either a Field Order or Change Order), will be deemed by Engineer as non-compliant with the Contract Documents and will be returned to Contractor without approval.
    d. Contractor is solely responsible for delays incurred due to substitutes proposed via Submittals that have not been previously duly approved via an appropriate Contract modification.
    e. Action Submittals for items or procedures approved via an appropriate Contract modification shall include a copy of the Contract modification in which the substitute was approved.
3. Submittals with Proposed Deviations from Contract Requirements:
    a. When Submittal proposes deviations from requirements of the Contract Documents, the Submittal shall clearly and expressly indicate each proposed deviation.
    b. Also comply with this Section's provision, in the Article below, on Contractor's transmittal letter expressly alerting Engineer to the proposed deviations.
    c. Comply with requirements of the Contract regarding substitutes and "or-equals".
    d. When deviation is proposed, also appropriately revise text of Contractor's approval, from that required below in this Article.
    e. When Submittal includes deviations from Contract requirements and either the Submittal itself, Contractor's transmittal letter, or both, do not comply fully with Contract requirements for indicating deviations in Submittals and giving separate written notice thereof, Engineer's approval of such deviations will be deemed null and void unless Engineer's written response to the Submittal has expressly acknowledged such deviation and indicated Engineer's approval thereof.
    f. Contractor is solely responsible for delays and costs incurred due to any and all Submittals with deviations from Contract requirements that were not properly, expressly indicated and approved in accordance with the Contract Documents. Deviations not duly approved in accordance with the Contract Documents may be deemed defective Work. Contractor is solely responsible for remedying defective Work and all associated cost and time impacts.

G. Contractor's Approval of Submittals:
1. Contractor's Review: Before transmitting Submittals to Engineer, review each Submittal to:
    a. Ensure proper coordination of the Work.
    b. Determine that each Submittal is in accordance with Contractor's desires.
    c. Verify that Submittal contains sufficient information for Engineer to determine compliance with the Contract Documents.
2. Incomplete or inadequate Submittals will be returned without detailed review by Engineer.
3. Contractor's Approval Stamp and Signature:

a. Each Submittal furnished shall bear Contractor's approval stamp (or facsimile thereof) and signature, as evidence that the Submittal has been reviewed and approved by Contractor and verified as complete and in accordance with the Contract Documents.
b. Submittals without Contractor's approval and signature (as required by the contract Documents) will be returned to Contractor without further review by Engineer and deemed incomplete.
c. Engineer reserves the right to reject as incomplete Submittals where Contractor's approval signature appears computer-generated or reproduced without the active involvement or review of Contractor's signatory.
d. Contractor's approval shall contain the following text:

Project Name: _____
Contractor's Name: _____
Contract Designation: _____
Date: _____

---------- *Reference* ----------

Submittal Title: _____
Specifications:
Section: _____
Page No.: _____
Paragraph No.: _____
Drawing No.: _____of _____
Location of Work: _____

Submittal No. and Review Cycle: _____
Coordinated by Contractor with Submittal Nos.: _____
_____

I hereby certify that Contractor has satisfied Contractor's obligations under the Contract Documents relative to Contractor's review and approval of this Submittal, including: (1) reviewed and coordinated the Submittal with other Submittals and with the requirements of the Work and the Contract Documents; (2) determined and verified all: field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal, (b) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work, and (c) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; (3) confirmed the Submittal is complete with respect to all related data included in the Submittal; and (4) clearly and expressly indicated all proposed deviations (if any) from the requirements of the Contract Documents both in the Submittal itself and in the Submittal's transmittal letter. Accordingly, this Submittal is hereby approved for Contractor by:

Approved for Contractor by: _____

H. Resubmittals:
1. Refer to the General Conditions, as may be modified by the Supplementary Conditions, for requirements regarding resubmitting required Submittals.
2. In addition to limits on the quantity of resubmittals, as indicated in the General Conditions, Contractor shall furnish Submittals with such completeness, accuracy, and compliance with the Contract Documents to obtain Engineer's approval or acceptance, as applicable, without the total quantity of Submittals furnished, including all initial Submittals and all resubmittals, exceeding 125 % of the number of Submittals indicated on the Schedule of Submittals initially accepted by Engineer, plus a corresponding percentage of the quantity of Submittals required by Change Orders, Work Change Directives, and Field Orders.

3. Do not increase the scope of prior review cycle of the same Submittal.
4. Indicate on Contractor's transmittal letter how Submittal was revised from previous review cycle of the Submittal and where the revisions or corrections are located within the resubmittal.
5. Expressly address and provide response for all components previously transmitted by Engineer on prior review cycles of the subject Submittal. Where resubmittal lacks complete response to Engineer's prior comments, Engineer may deem such resubmittal as incomplete and return it to Contractor without further review.
6. Where part of the Submittal's prior review cycle was expressly approved or accepted, as applicable, by Engineer, do not include such items in subsequent resubmittals.
7. Indicate, "Not Yet Resolved—To Be Resubmitted at a Later Date" for any items not approved in prior review cycle of the Submittal for items not included in the subject resubmittal. Engineer reserves the right to deem incomplete Submittals "Not Approved" or "Revise and Resubmit". Furnishing incomplete or partial resubmittals is discouraged.
8. Resubmittal of Previously Approved or Accepted Items:
    a. Do not resubmit on a given item previously approved or accepted, as applicable, by Engineer, without Engineer's advance consent. Consent will be given for bona-fide unavailability of a previously approved or accepted item where Contractor has acted in good faith in a timely manner with due diligence to comply with the Contract Times.
    b. Destroy or conspicuously mark "SUPERSEDED" on all documents having previously received Engineer's approval or acceptance, as applicable, that are superseded by a resubmittal.

1.7 TRANSMITTAL OF SUBMITTALS BY CONTRACTOR

A. Contractor's Transmittal Letters for Submittals:
1. Furnish separate transmittal letter with each Submittal. Use transmittal form attached to this Section (as Exhibit 01 33 00-A) unless other transmittal form is acceptable to Engineer at the start of the Project's construction.
2. When transmittal form other than this Section's Exhibit 01 33 00-A is acceptable to Engineer, at beginning of each transmittal, include a reference heading indicating: Contractor's name, City's name, Project designation, Contract designation, transmittal number, and Submittal number (with review cycle).
3. "Or-Equals": When the Submittal is proposing an "or-equal", expressly so indicate on transmittal form submitted by Contractor.
4. Proposed Deviations from Contract Requirements: When the Submittal proposes deviations from requirements of the Contract Documents, transmittal letter shall specifically describe each proposed deviation.

B. Submittal Delivery Method:
1. This provision presents general requirements for delivery or all Submittals unless otherwise required elsewhere in the Contract Documents.
2. Furnish Submittals as Electronic Documents delivered in accordance with Section 01 31 26 – Electronic Communication Protocols.
3. Furnish Submittals to Engineer and each other entity indicated in the Contract Documents as receiving a Submittal directly from Contractor.
4. Address Submittals to Engineer as follows: HDR, indicate complete physical address of Engineer's project office suitable for delivery of packages, to attention of Travis Moore, 1670 Broadway, Suite 3400, Denver, CO 80202, Travis.Moore@hdrinc.com.
5. Simultaneously with delivering Electronic Documents Submittal to Engineer, also deliver:
    a. Electronic Documents Submittal to Owner's Site Representative (OSR).

C. Samples - Transmittal and Delivery:
1. Labeling and Tagging Samples:
    a. Securely label or tag each Sample with Submittal identification number.
    b. Label or tag shall include clear space at least 4 inches by 4 inches in size for affixing Engineer's review stamp indicating disposition assigned by Engineer.
    c. Label or tag shall not cover, conceal, or alter Sample's appearance or features.

d. Label or tag shall not be separated from the Sample.

2. Timing: Deliver required Samples concurrently with other Action Submittals required for the same element of the Work, unless other delivery time frame is indicated in the Schedule of Submittals accepted by Engineer.
3. Quantity Required:
   a. For reasonably portable Samples, deliver the quantity of Samples required in the associated Specifications. If quantity of Samples is not indicated in the associated Specifications section, deliver to Engineer not less than three identical Samples of each item for which Sample is required.
   b. Samples will not be returned to Contractor. If Contractor requires Sample(s) for Contractor's use, so advise Engineer in writing and furnish additional copies of the Sample. Contractor is responsible for furnishing, shipping, and transporting additional Samples.
4. Locations for Delivery of Reasonably Portable Samples for Review:
   a. Deliver one physical Sample to Owner's Site Representative's field office at the Site.
   b. Deliver balance of required physical Samples to Engineer at address indicated in this Article for receipt of Submittals, unless otherwise directed by Engineer.

D. Closeout Submittals –Transmittal and Delivery:
1. Furnish the following Closeout Submittals in accordance with general requirements for transmitting and delivering Submittals, indicated above in this Article: maintenance contracts; warranty bonds (when required) and other bonds required for specific materials, equipment, or systems; warranty documentation; and sustainable design closeout documentation (when required). On documents such as maintenance contracts and bonds, include on each document furnished original ("wet") signature of entity issuing said document. When original "wet" signatures are required, furnish such Submittals to Engineer both on original paper and as Electronic Documents, and to other entities furnish as indicated above in this Article for general requirements for Submittals.
2. Record Documents: Submit in accordance with Section 01 78 39 - Project Record Documents.
3. Software: In addition to software installed on City's computer system, furnish number of copies of software required in the Specifications section where the software is specified. Preferred means of transmittal is via secure file transfer directly to City via secure file transfer method mutually acceptable to software developer and the receiving entity. When secure file transfer is used, submit to Engineer documentation signed or electronically acknowledged by City that the files were received. Where such software is available only on the software developer's portable media, furnish such software on software developer's original, portable media, sealed in software developer's original, unopened, clearly labeled packaging.

E. Maintenance Materials Submittals – Delivery:
1. Deliver physical maintenance materials required by the Contract Documents in accordance with applicable provisions of the Contract.
2. Submit documentation of delivery of (Maintenance Materials Submittals) in accordance with general requirements for Submittals as indicated in this Section.

1.8 ENGINEER'S REVIEW OF SUBMITTALS

A. This Article applies to review of all Submittals by Engineer or other entity to whom the Contract Documents require such Submittal be furnished.

B. Timing:
1. Timing of Engineer's review will be in accordance with the Schedule of Submittals accepted by Engineer.
2. When Submittal is delivered to Engineer on a date other than that indicated in the Schedule of Submittals accepted by Engineer, duration of Engineer's review may differ from that indicated in the Schedule of Submittals, based on Engineer's availability and resources. Engineer will make good-faith effort to furnish responses to Submittals in a timely manner.

3. Contractor is responsible for communicating to Engineer when a Submittal is on the Project's critical path.

C. Engineer's Review:
   1. Markings:
      a. Comments or responses marked directly on Submittal by Engineer (or other entity reviewing Submittal) will be colored red.
      b. Engineer may also present narrative comments on a comment sheet inserted by Engineer into the Submittal or included on Engineer's transmittal letter for the Submittal. Such comments will be in black text. When a separate comment sheet is included by Engineer, such sheet will be clearly identified as Engineer's comments.
   2. Engineer's review and disposition assigned to Submittal are subject to the following:
      a. Submittal disposition is subject to: Engineer's comments on the Submittal; disclaimer language on Engineer's Submittal transmittal letter; Engineer's Submittal review stamp (when used) or equivalent (when used); and this provision.
      b. Engineer's review is only for general compatibility with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, and for general compliance with the information given in the Contract Documents.
      c. Contractor shall be solely responsible for complying with the Contract Documents, as well as with Supplier instructions consistent with the Contract Documents, City's directions, and Laws and Regulations. Contractor is solely responsible for obtaining, correlating, confirming, and correcting dimensions at the Site; quantities; information and choices pertaining to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.
      d. Engineer is not responsible for resubmittals not yet furnished by Contractor or tracking Contractor's progress on resubmittals.
   3. Documents not required by the Contract Documents but nonetheless furnished by Contractor as submittals will not be reviewed by Engineer.

D. Meaning of Submittal disposition Assigned by Engineer:
   1. Action Submittals:
      a. "Approved" (Action Code A): Upon return of Submittal marked "Approved", order, ship, or fabricate materials and equipment included in the Submittal (pending Engineer's approval or acceptance, as applicable, of production-related qualifications statements and certifications, and required source quality control Submittals) or otherwise proceed with the Work in accordance with the Submittal and the Contract Documents.
      b. "Approved as Noted" (Action Code B): Upon return of Submittal marked "Approved as Noted", order, ship, or fabricate materials and equipment included in the Submittal (pending Engineer's approval or acceptance, as applicable, of production-related qualifications statements and certifications, and required source quality control Submittals) or otherwise proceed with the Work in accordance with the Submittal and the Contract Documents, and in accordance with Engineer's comments and notes indicated in Engineer's Submittal response
      c. "Revise and Resubmit" (Action Code C): Upon return of Submittal marked "Revise and Resubmit", make the revisions necessary and indicated and resubmit to Engineer for approval.
      d. "Not Approved" (Action Code D): This disposition indicates material or equipment that cannot be approved. "Not Approved" disposition may also be applied to Submittals that are incomplete. Upon return of Submittal marked "Not Approved", repeat initial submittal procedure utilizing approvable material or equipment, with a complete Submittal clearly indicating all information required.
   2. Informational, Closeout, and Maintenance Materials Submittals:

a. "Accepted" (Action Code F): Information included in Submittal complies with the applicable requirements of the Contract Documents and is acceptable. No further action by Contractor is required relative to such Submittal, and the Work covered by the Submittal may proceed. Materials and equipment with Submittals with this disposition may be shipped or operated, as applicable. Submittals assigned "Accepted" by Engineer (or other reviewing entity) does not indicate Engineer's acceptance of the associated Work, which is indicated only as set forth in the General Conditions and Section 01 77 19 – Closeout Requirements.
b. "Not Acceptable" (Action Code G): Submittal, or part thereof, does not indicate full compliance with applicable requirements of the Contract Documents and is not acceptable. Provide labor, materials, equipment, services, and incidentals necessary to properly and accurately revise Submittal and resubmit to indicate acceptability and compliance with the Contract Documents

3. Other:
   a. "Submittal Not Reviewed" (Action Code E): Documents so marked by Engineer are not required by the Contract Documents. Submittals may also be marked with this disposition when information in the document was previously reviewed and approved or accepted by Engineer, as applicable.

E. Distribution of Engineer's Responses:
1. Unless otherwise indicated in the Contract Documents, Engineer will distribute written responses (as Electronic Documents) to Submittals to the following:
   a. Contractor.
   b. City.
   c. Owner's Site Representative (OSR).
   d. Engineer's file.
2. Engineer's acceptance of Informational Submittals, Closeout Submittals, and Maintenance Materials Submittals will be recorded in Engineer's Submittal log. Copy of Engineer's Submittals log is available from Engineer upon written request of City or Contractor. If no such request is received by Engineer, Engineer will distribute copy of Engineer's Submittals log once per month (when Submittals have been received or acted on by Engineer). Engineer may distribute copy of Engineer's Submittals log as an Electronic Document or as handout at construction progress meetings.
3. Paper copies of Engineer's Submittal responses will not be distributed unless otherwise required by the Contract Documents or otherwise agreed to by Engineer.
4. Contractor is responsible for forwarding Engineer's Submittals responses to Subcontractors and Suppliers as appropriate, and for coordinating the Work of all trades.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The documents listed below, following this Section's "End of Section" designation, are part of this Specifications Section:
1. "Exhibit 01 33 00-A – Transmittal for Submittal No. _____" (one page).

END OF SECTION

Exhibit 01 33 00-A

Transmittal for Submittal No. _____-_____

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn (Contractor):	Attn (HDR):	Review Cycle	
Date Transmitted by Contractor:	Date of Engineer's Response Transmittal:		

Item No.	Submittal No.	Description (indicate number of copies where paper copies of physical Samples are returned)	Manufacturer	Supplier Dwg or Data No.	Engineer's Disposition (Action Code) *
1					
2					
3					
4					

Contractor's Remarks *(insert text)*:

Engineer's Remarks *(insert text)*: :

* **Legend for Action Code** indicated above, assigned by Engineer:

Action Submittal:
- A – Approved
- B – Approved as Noted
- C – Revise and Resubmit
- D – Not Approved
- E – Submittal Not Reviewed

Informational, Closeout, or Maintenance Materials Submittal:
- F – Accepted (this code normally recorded in Engineer's Submittals log).
- G – Not Acceptable

Engineer's Disclaimer (for Submittals that do not involve delegated design):

a. Submittal action code is subject to: Engineer's comments on the Submittal, comment sheets (if any), and this transmittal letter; disclaimer language on Engineer's Submittal review stamp or equivalent; and Specifications Section 01 33 00 – Submittal Procedures.

b. Engineer's review is only for general compatibility with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, and for general compliance with the information given in the Contract Documents.

c. Contractor shall be solely responsible for complying with the Contract Documents, as well as with Supplier instructions consistent with the Contract Documents, City's directions, and Laws and Regulations. Contractor is solely responsible for obtaining, correlating, confirming, and correcting dimensions at the Site; quantities; information and choices pertaining to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.

Reviewed for HDR by:	**Date of Engineer's Review:**

Distribution: Contractor ☐ File ☐ Field ☐ City ☐ Other ☐

SECTION 01 61 03
EQUIPMENT - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

B. Related Sections include but are not necessarily limited to:

1. Section 03 15 19 - Anchorage to Concrete.
2. Section 10 14 00 - Identification Devices.
3. Section 40 61 13 - Process Control System General Requirements.
4. Section 40 67 00 - Control System Equipment Panels and Racks.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. American Gear Manufacturers Association (AGMA).
3. American Petroleum Institute
   a. API 686 - Recommended Practice for Machinery Installation and Installation Design
4. ASTM International (ASTM):
   a. E1934, Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography.
   b. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
5. Hydraulic Institute (HI):
   a. 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
6. International Electrotechnical Commission (IEC).
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
8. The International Society of Automation (ISA).
9. International Organization for Standardization (ISO):
   a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.
   b. 21940-11, Mechanical Vibration - Rotor Balancing - Part 11: Procedures and Tolerances for Rotors with Rigid Behavior.
10. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. ICS 6, Enclosures for Industrial Control and System.

11. InterNational Electrical Testing Association (NETA):
    a. ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
12. National Fire Protection Association (NFPA):
    a. 70, National Electrical Code (NEC):
13. National Institute for Certification in Engineering Technologies (NICET).
14. National Institute of Standards and Technology (NIST).
15. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
16. Underwriters Laboratories, Inc. (UL).
    a. 508, Standard for Safety Industrial Control Equipment.
    b. 508A, Standard for Safety Industrial Control Panels.
    c. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.

B. Miscellaneous:

1. A single manufacturer of a "product" shall be selected and utilized uniformly throughout Project even if:
    a. More than one manufacturer is listed for a given "product" in Specifications.
    b. No manufacturer is listed.
2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations and defined in the Electrical specifications.

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Equipment:

1. One or more assemblies capable of performing a complete function.
2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

C. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

D. Baseplate or equipment base plate or machine base

1. Are fabricated frames of structural shapes and plates with enough strength and sturdiness to serve as the surface to which other equipment is attached to and supported by. Baseplates can be directly mounted and grouted to concrete equipment support bases or machined and bolted to a sole plate.

E. Sole plate

1. A thick steel machined plate that is attached to and grouted to a concrete equipment support base.
2. Base plates are bolted to a sole plate when a sole plate is specified and/or provide.

1.4 SUBMITTALS

A. Shop Drawings:

1. General for all equipment:
    a. Data sheets that include manufacturer's name and complete product model number.
        1) Clearly identify all optional accessories that are included.
    b. Acknowledgement that products submitted comply with the requirements of the standards referenced.
    c. Manufacturer's delivery, storage, handling, and installation instructions.
    d. Equipment identification utilizing numbering system and name utilized in Drawings.
    e. Equipment installation details:
        1) Location of anchorage.
        2) Anchorage setting templates.
        3) Manufacturer's installation instructions.
    f. Equipment area classification rating.
    g. Shipping and operating weight.
    h. Equipment physical characteristics:
        1) Dimensions (both horizontal and vertical).
        2) Materials of construction and construction details.
    i. Equipment factory primer and paint data.
    j. Manufacturer's recommended spare parts list.
    k. Equipment lining and coatings.
    l. Equipment utility requirements include air, natural gas, electricity, and water.
    m. Ladders and platforms provided with equipment:
        1) Certification that all components comply fully with OSHA requirements.
        2) Full details of construction/fabrication.
        3) Scaled plan and sections showing relationship to equipment.
2. Systems schematics and data:
    a. Provide system schematics where required in system specifications.
        1) Acknowledge all system components being supplied as part of the system.
        2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
        3) Provide technical data for each system component showing compliance with the Contract Document requirements.
        4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.

B. Factory Test Reports:

1. Equipment performance tests.
    a. As listed in individual equipment specifications.

C. Informational Submittals:

1. Notification, at least one week in advance, that testing will be conducted at factory.
2. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.

3. Submit sample Manufacturer's Field Service Report (MFSR). Report shall use manufacturer's standard report or use the form in the Exhibits and have at least the following information:
    a. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
    b. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
    c. Provide three bound final written reports documenting natural frequency testing, vibration monitoring and testing for specified equipment.
        1) Include the acceptance criteria of all equipment tested.
        2) Provide individual tabbed sections for information associated with each piece of tested equipment.
    d. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.
    e. Testing and monitoring reports in accordance with PART 3 of this Specification Section.
4. Submit completed Manufacturer's Field Service Report (MFSR) for each piece of equipment supplied.

D. Refer to Section 01 81 33 – Cyber Security Requirements for required cyber security related submittals.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Anchorage:

1. Cast-in-place anchorage:
    a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
    b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
    c. Provide two nuts for each bolt.
2. Drilled anchorage:
    a. Adhesive anchors per Section 03 15 19.
    b. Threaded rods same as cast-in-place.

2.2 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

C. Furnish like parts of duplicate units to be interchangeable.

D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on the Drawings and other Contract Documents, in accordance with manufacturer's written instructions, and in accordance with Laws and Regulations. Where the Contract Documents, manufacturer's written instructions, or Laws and Regulations conflict, obtain interpretation or clarification from Engineer before proceeding.

B. Utilize appropriate templates for anchorage placement for equipment installed on concrete.

3.2 WIRING CONNECTIONS AND TERMINATION

A. Clean wires before installing lugs and connectors.

B. Coat connection with oxidation eliminating compound for aluminum wire.

C. Tape stripped ends of conductors and associated connectors with electrical tape.

1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.

D. Connections to carry full ampacity of conductors without temperature rise.

E. Terminate spare conductors with electrical tape.

3.3 FIELD QUALITY CONTROL

A. General:

1. Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
2. Execute pre-demonstration requirements in accordance with Section 01 75 00.
3. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
4. Provide testing for all equipment furnished or installed as part of the Work.
5. Repair or replace equipment shown to be out of range of the acceptable tolerance until the equipment meets or exceeds acceptable standards.
6. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
    a. Contract Drawings and Specifications.
    b. Related construction change documentation.
    c. Approved Shop Drawings.
    d. Approved Operation and Maintenance Manuals.
    e. Other pertinent information as required.

B. Instruments Used in Equipment and Connections Quality Control Testing:

1. Minimum calibration frequency:
    a. Field analog instruments: Not more than 6 months.
    b. Field digital instruments: Not more than 12 months.
    c. Laboratory instruments: Not more than 12 months.
    d. If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.
2. Carry current calibration status and labels on all testing instruments.
3. See individual testing programs for additional instrumentation compliance requirements.

C. Testing and Monitoring Program Documentation:

1. Provide reports with tabbed sections for each piece of equipment tested.
2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
    a. Include legible copies of all forms used to record field test information.
3. Prior to start of testing, submit one copy of preliminary report format for Engineer review and comment
    a. Include data gathering and sample test report forms that will be utilized.
4. In the final report, include as a minimum, the following information for all equipment tested:
    a. Equipment identification, including:
        1) Name and tag numbers identified in the Contract Documents.
        2) Manufacturer's serial numbers.
        3) Other pertinent manufacturer identification,
    b. Date and time of each test.
    c. Ambient conditions including temperature, humidity, and precipitation.
    d. Visual inspection report.
    e. Description of test and referenced standards, if any, followed while conducting tests.
    f. Results of initial and all retesting.
    g. Acceptance criteria.
    h. "As found" and "as left" conditions.
    i. Corrective action, if required, taken to meet acceptance.
    j. Verification of corrective action signed by the Contractor, equipment supplier, and City's representative.
    k. Instrument calibration dates of all instruments used in testing.
5. Provide three (3) bound final reports prior to Project final completion.

3.4 DEMONSTRATION

A. Demonstrate equipment in accordance with Section 01 75 00.

3.5 ABBREVIATION TABLE

A. As indicated on the Drawings.

3.6 CLOSEOUT ACTIVITIES

A. Refer to Section 01 81 33 – Cyber-Security Requirements for cyber security related closeout requirements.

END OF SECTION

EXHIBIT A

MANUFACTURER FIELD SERVICE REPORT

This field service report is generic in nature. An electronic copy of this form will be furnished upon request from the Engineer. This report is to reflect that all requirements of the Operations and Maintenance Manual and the individual equipment specification requirements have been performed for the installation and operation and also to provide a baseline for amperage draw for each phase, vibration readings, rotation, alignment and all other applicable tests required to insure that the equipment has been installed properly. A MFSR will be required for each individual piece of equipment requiring a MFSR.

Definitions of Reports:

Initial service report: Required for construction preparations. Equipment delivered to site is in good condition and conforms to specification requirements. Anchor bolts, hardware and ancillary items (piping, flanges, conduits, fuel/power supply) are compatible with equipment.

Interim service report: Required for equipment installation onto base or foundation. Piping connections, electrical and control connections or structural attachment are complete. For equipment stored on site over four weeks, interim service report will document that manufacturer's long-term storage procedures have been incorporated and equipment has not been damaged, nor coatings deteriorated.

Final service report is to be completed when equipment can be started, electrical amperage and voltage draw measured, cold and hot alignments performed, vibration testing and monitoring performed and the equipment is found to be in compliance with Manufacturer's operating parameters and the requirements of the individual equipment specifications.

PROJECT: _____

Report Status:

Initial Service Report completed and submitted on _____

Interim Service Report completed and submitted on _____

Final Service Report completed and submitted on _____

Commencement of Warranty _____

I Description

A. Equipment Name and Identification: _____

_____

B. Serial Number: _____

C. Specification Section Number: _____

D. Manufacturer: _____

E. Representative: _____

F. Type of Service: Initial _____Interim _____Final _____

II General Review

A. The above referenced equipment/material/supplies have been inspected, checked, and adjusted. Yes _____ No _____

Summary: _____

_____

Summary: _____

_____

B. The above referenced equipment/material/supplies are free from any undue stress imposed by any connected piping, anchor bolts or any other load. N/A _____ Yes _____No _____

_____

C. The above referenced equipment/material/supplies have operated under design conditions. N/A _____Yes _____No _____

Summary: _____

_____

D. The above referenced equipment/material/supplies have been installed in accordance with the manufacturer's recommendations and the Procurement Documents, require no corrective work, and are hereby approved. Yes _____No _____

Summary: _____

_____

E. The above referenced equipment/material/supplies are acceptable to the manufacturer as installed providing the following corrective action(s) are performed:

1. _____
2. _____
3. _____
4. _____
5. _____

III Inspection Checklist

Item	Acceptable (Yes/No)	Readings/Comments
Bearings (1)		
Belts (tension reading)		
Lubrication Levels		
Vibration (1) (2) (MILS/SEC)		
Infrared Thermography (1) (2)		
Starting AMPS		
Full Load AMPS		
Volts		
Rotation		
Jacket Temperature (DEGF)		
Seal Water Flow Rate (GPH or GPM)		
Seal Water Pressure (PSI)		
O-rings/Packing		
Alignment (1)		
Anchor Bolts		
Anchor Bolt Torque		
Grout		
Substrate Approval		
Sound level (4 feet from unit) (1) (dB)		
Other		

Item	Acceptable (Yes/No)	Readings/Comments

(1) Inspection or testing reports must be attached.
(2) Provide vibration testing and monitoring procedures for Engineer's review and approval prior to testing.

IV O&M Manuals

A. The O&M manual as presented contains all information required for proper operation, maintenance, and instruction of this system. N/A _____Yes _____No _____

Summary: _____

_____

V Preventive Maintenance

A. The preventive maintenance summary outlined in the O&M manual is acceptable for operation of the system throughout the warranty period. N/A _____Yes _____No _____

Summary: _____

_____

VI Operator Training/Classroom Instruction

A. Training and instruction have been performed in accordance with the requirements of the Procurement Documents. N/A _____Yes _____No _____

B. Final Training/Classroom Instruction Completed on: _____

Summary: _____

_____

VII Remarks

_____

_____

_____

VIII Certification

I hereby certify, that I, _____, am a duly authorized representative of the manufacturer, that I am empowered by the manufacturer to inspect, approve, and operate his equipment, and that I am authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as modified herein. I also certify that all information contained herein is true and accurate.

By: _____
(Authorized Representative)

For: _____

Date: _____

IX Acknowledgments

By: _____

For: _____
(Contractor)

Date: _____

By: _____

For: _____
(Engineer)

Date: _____

SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Methods of installing and sealing openings and penetrations in construction.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   b. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
2. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC):
      1) Article 501, Class 1 Locations.
   b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
   c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 SUBMITTALS

A. Shop Drawings:

1. For each structure provide dimensioned or scaled (minimum 1/8 inches = 1 foot) plan view drawings containing the following information:
   a. Vertical and horizontal location of all required openings and penetrations.
   b. Size of all openings and penetrations.
   c. Opening type.
   d. Seal type.
2. Manufacturer's installation instructions for standard manufactured products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Sleeves:

1. All other Areas:
   a. Steel, Hot-dipped galvanized after fabrication.
   b. Penetrations 24 inches diameter or less: ASTM A53, Schedule 40.

B. Modular Mechanical Seals:

1. Acceptable manufacturers:
   a. Link-Seal.
2. 316 stainless steel bolts, nuts and washers.

C. Sheet Metal Sleeves:

1. All other areas: Galvanized steel: ASTM A653, G90.
2. Minimum 12 GA.

D. Commercial Wall Castings:

1. Ductile iron, ASTM A536.
2. Grade equal to connecting piping system.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Obtain prior approval from Engineer when any opening larger than 100 square inches must be made in existing or newly completed construction.

B. Perform electrical penetrations in accordance with NFPA 70, Article 501.

C. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.

1. In non-washdown areas, install sleeves with ends flush with finished surfaces.

D. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

E. Where pipes, conduits or ducts pass through grating, provide banding at the entire perimeter of the opening.

F. Do not cut into or core drill any beams, joists, or columns.

G. Do not install sleeves in beams, joists, or columns.

H. Do not install recesses in beams, joists, columns, or slabs.

I. Field Cutting and Coring:

1. Saw or core drill with non-impact type equipment.
2. Mark opening and drill small 3/4 inches or less holes through structure following opening outline.
3. Sawcut opening outline on both surfaces.
    a. Knock out within sawcuts using impact type equipment.
    b. Do not chip or spall, face of surface to remain intact.
    c. Do not allow any overcut with saw kerf.

J. Precast-Prestressed Concrete Construction:

1. Do not cut openings or core drill vertically or horizontally through stems of members.
2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.

K. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.

L. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

M. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

N. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.

O. Modular Mechanical Seals:

1. Utilize one seal for concrete thickness less than 8 inches and two seals for concrete, 8 inches thick or greater.
2. Install seals such that bolt heads are located on the most accessible side of the penetration.

3.2 SCHEDULES

A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:

1. Provide the following opening and penetration types:
    a. Type A - Block out 2 inches larger than outside dimensions of duct, pipe, or conduits.
    b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
    c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
    d. Type D - Commercial type casting or fabrication.
    e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
    f. Type F - Integrally cast pipe, duct or conduit.
    g. Type G - Saw cut or line-drill and remove area 1 inch larger than outside dimensions of duct, pipe or conduit.
    h. Type H - Core drill.
    i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
    j. Type J - Grating Banding for any field cut openings.
2. Provide seals of material and method described as follows.
    a. Category 1 - Modular Mechanical Seal.
    b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings.
    c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
    d. Category 4 - Backer rod and sealant.
    e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.
    f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 inches larger than opening.
    g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
    h. Category 8 - Banding for all grating openings and banding and cover plate of similar materials for abandoned openings.
3. Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.
4. Furnish openings and sealing materials through existing floors, grating, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.

SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE FOR NEW CONSTRUCTION

APPLICATIONS	CONDUIT	
	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F	7 Not Req
Through floors on grade above water table	C F I (1)	4 Not Req 7
Through slab on grade below water table	F	Not Req
Through floors in washdown areas	F H (2) I (1)	Not Req 3 7
Through walls where one side is a hazardous area	C F	7 Not Req
Through exterior wall below grade above water table	F I (1)	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F H (2) I (1)	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req
Through exterior wall above grade	C H (2)	5 4
Roof penetrations	A	2
Through interior walls and slabs not covered by the above applications	A C F	4 4 Not Req
Grating openings and penetrations	J	8

SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE FOR EXISTING CONSTRUCTION

APPLICATIONS	CONDUIT	
	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	B (1) E (3) H (2)	7 Not Req 7
Through floors on grade above water table	B	7
Through slab on grade below water table	E	Not Req
Through floors in washdown areas	G H (2)	3 3
Through walls where one side is a hazardous area	B (1) (3) E H (2)	7 Not Req 7
Through exterior wall below grade above water table	B (1) (3) H (2)	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B (1) (3) E H (2)	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	E	Not Req
Through exterior wall above grade	G (1) (3) H (2)	5 7
Roof penetrations	G	2
Through interior walls and slabs not covered by the above applications	G (1) (3) H (2)	4 4
Grating openings and penetrations	J	8

(1) Multiple piping 3 inches and smaller or multiple conduits.
(2) Single pipe 3 inches and smaller or single conduit.
(3) Single pipe or conduit larger than 3 inches.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for cutting and patching Work.

B. Scope:

1. Contractor shall perform cutting and coring, and rough and finish patching of holes and openings in existing construction.
2. Provide cutting, coring, fitting, and patching, including attendant excavation and fill, required to complete the Work, and to:
   a. remove and replace defective Work;
   b. remove samples of installed Work as specified or required for testing;
   c. remove construction required to perform required alterations or additions to existing construction;
   d. uncover the Work for Engineer's observation of covered Work, testing, or inspection by testing entities, or observation by authorities having jurisdiction;
   e. connect to completed Work not performed in proper sequence;
   f. remove or relocate existing utilities and piping that obstruct the Work in locations where connections are to be made;
   g. make connections or alterations to existing or new facilities.

C. Related Requirements:

1. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:

1. Cutting and Patching Request:
   a. Submit written request to Engineer, well in advance of executing cutting or alteration that affects one or more of the following:
      1) Design function or intent of Project.
      2) Work of City or other contractors retained by City.
      3) Structural capacity or integrity of an element of the Project, building, or structure.
      4) Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
      5) Efficiency, operational life, maintenance, or safety of operational elements.
      6) Visual qualities of elements that will be exposed to view after completion of the Work.
   b. Request shall include:
      1) Identification of Project and Contract designation.
      2) Description of affected Work of Contractor and work of others (if any) retained by City.
      3) Necessity for cutting.
      4) Effect on work or operations of City and other contractors (if any) retained by City, and on structural and weatherproof integrity of Project, building, or structure.
      5) Description of proposed Work, indicating: scope of cutting and patching; trades that will execute the cutting and patching Work; materials and equipment to be used;

extent of refinishing; schedule of operations; alternatives (if any) to cutting and patching, and net effect on aesthetics following completion of finishing Work.

6) Indication of entity responsible for cost of cutting and patching, when applicable.

7) Written permission of other prime contractors (if any) whose work will or may be affected.

2. Recommendation Regarding Cutting and Patching:

a. Should conditions of work or schedule indicate a change of materials or specified methods, Submit written recommendation to Engineer including:

1) Conditions indicating change.

2) Recommendations for alternative materials or alternatives to specified methods.

3) Material manufacturer's printed recommendations for the proposed product and recommendations of manufacturer's technical representative for the specific application(s). The latter shall be on technical representative's letterhead and shall explicitly indicate the Project and specific cutting and patching application(s) to which the recommendation(s) apply.

4) Items required with request for approval of substitute, in accordance with the substitution request requirements of the Contract Documents.

3. Product Data:

a. Submit manufacturer's published data for the protective compound to be applied to core-drilled surfaces and cut concrete surfaces.

b. When not required under other Specifications sections, submit manufacturer's published data on materials to be used for finishing around the cut or patched area(s), together with indication of the location(s) where each is proposed for use.

c. Furnish Submittals for patching materials under the associated Specifications section. Submittal to include letter of recommendation from product manufacturer's technical representative indicating on technical representative's letterhead, explicitly indicating:

1) Project name and facility name;

2) specific cutting and patching application(s) to which the recommendations apply;

3) that product manufacturer's technical representative has personally observed and is familiar with conditions in the work area(s) of the subject cutting and patching;

4) materials that are the subject of the Submittal are appropriate for the condition(s) of the proposed patch and will remain durable in the patch's final exposure upon Substantial Completion; and.

5) patching material manufacturer's technical representative's recommendations for surface preparation, installation of patching material(s), and curing.

B. Informational Submittals: Submit the following:

1. Written Notification of Cutting and Patching:

a. Furnish as a Submittal written indication designating the day and time that the construction associated with cutting and patching will be uncovered to allow for observation. Do not begin cutting or patching operations until submittal is accepted by Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials – General:

1. Provide materials that comply with the Contract Documents.

2. If not shown or indicated in the Contract Documents, use materials identical to existing materials affected by cutting and patching Work.

3. For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, provide materials whose installed performance will equal or surpass that of existing materials.
4. Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, using materials that do not void required or existing warranties.

B. Compound Applied to Core-Drilled Surfaces and Cut Concrete Surfaces:

1. After core-drilling or sawcutting (as applicable) and before installing the utility or equipment through the penetration, coat exposed concrete and exposed steel with solvent-free, two-component, protective, epoxy resin coating.
2. Color shall approximate the finish color of the existing surface to be coated.
3. Product and Manufacturer: Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
   a. Sikagard 62, by Sika Corporation.
   b. Or equal.

C. Epoxy Patch Material:

1. Engage the manufacturer's representative to observe and recommend a suitable patching material of the actual construction conditions.
2. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
   a. Depth of patch greater than 3/4 inches:
      1) Five Star MP Epoxy Patch.
      2) Or equal.
   b. Depth of patch between 1/8 inches and 3/4 inches:
      1) Five Star Fluid Epoxy.
      2) Or equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Assessment – General:

1. Examine surfaces to be cut or patched, and conditions under which cutting or patching will be performed before starting cutting or patching Work.
2. Report unsatisfactory or questionable conditions to Engineer in writing.
3. Do not proceed with cutting or patching Work until unsatisfactory conditions are corrected.

B. Non-Destructive Investigation:

1. In advance of cutting or coring through existing slabs or walls, use non-destructive methods accepted by Engineer to determine location of reinforcing steel, electrical conduits, and other items embedded in slabs and walls.
2. Submit to Engineer written report of findings of evaluation.
3. Perform investigation and submit results to Engineer sufficiently in advance of cutting Work to allow time to identify and implement alternatives, if changes to the Work are necessary because of conduit or other features in floor or wall.

3.2 PREPARATION

A. Provide temporary support required to maintain structural integrity of facilities, to protect adjacent work from damage during cutting, and to support the element(s) to be cut.

B. Protection of Existing Construction during Cutting and Patching:

1. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project and facility that will be exposed during cutting and patching operations.
2. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
3. Do not cut existing pipe, conduit, ductwork, or other utilities serving facilities scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 CUTTING AND PATCHING – GENERAL

A. Perform cutting and coring in such manner that limits extent of patching required.

B. Structural Elements:

1. Do not cut or patch structural elements in manner that would change the element's structural load-carrying capacity as load deflection ratio.

C. Operating Elements:

1. Do not cut or patch operating elements in manner that would reduce their capacity to perform as intended.
2. Do not cut or patch operating elements or related components in manner that would increase maintenance requirements or decrease operational life or safety.

D. Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, using methods that do not void required or existing warranties.

E. Provide adequate temporary covering over openings (whether cut or core-drilled) where not in use. Avoid creating tripping hazards for openings provided in floors and slabs.

3.4 CORING

A. Use core-drilling to make penetrations through concrete and masonry walls, slabs, or arches, unless otherwise accepted by Engineer in writing.

B. Coring:

1. Perform coring with non-impact rotary tool using diamond core-drills. Size holes for pipe, conduit, sleeves, equipment or mechanical seals, as required, to be installed through the penetration.
2. Do not core-drill through electrical conduit or other utilities embedded in walls or slabs. To extent possible, avoid cutting reinforcing steel in slabs and walls.

C. Protection:

1. Protect existing equipment, utilities, and adjacent areas from water and other damage caused by or resulting from core-drilling operations.
2. After core-drilling and before installing the utility or equipment through the penetration, coat exposed concrete and steel with protective coating material indicated in Paragraph 2.1.B of this Specification Section. Apply protective coating in accordance with manufacturer's instructions.

D. Cleaning:

1. After core-drilling, vacuum or otherwise remove slurry and tailings from the work area.

3.5 CUTTING

A. Cutting – General:

1. Cut existing construction using methods least-likely to damage elements retained and adjoining construction and that provide proper surfaces to receive subsequent installation or repair.
2. In general, use hand tools or small power tools suitable for sawing or grinding. When possible, avoid using hammering and avoid chopping. Carefully chip out concrete where necessary and as indicated in the Contract Documents.

3. Cut holes and slots as small as possible, neatly to the size required, and with minimum disturbance of adjacent surfaces.
4. Prior to starting cutting, provide adequate bracing of area to be cut.
5. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed side.
6. Use equipment of adequate size to remove the cut panel or “coupon”.

B. Cutting – Concrete and Masonry:

1. Cut through concrete and masonry using concrete wall saw with diamond saw blades.
2. On both sides of the element being cut, provide for control of slurry generated during sawing.
3. Concrete Cutting:
    a. Make openings by sawing through existing concrete. Core drill with 6 inches diameter core at the corners of openings to avoid overcutting at corners.
    b. When the cut-out concrete or “coupon” cannot be removed in one piece, or where concrete is too thick for saw to penetrate fully, break out concrete after initial saw cuts.
    c. Where saw cutting is not possible:
        1) Make openings by drilling holes around perimeter of required opening and subsequently carefully chip out concrete.
        2) Holes shall be sufficient in quantity to prevent damage to remaining concrete.
4. Sizing and Repair of Cut Concrete Surfaces:
    a. Oversize required openings in existing concrete by one inch on all sides and build back to required opening size by providing epoxy grout bonded to existing concrete.
    b. Where oversizing the cut opening by one inch is not possible, cut the opening to the required dimensions. After cutting concrete and before installing subsequent construction on or through the opening, coat exposed concrete and steel with protective coating material indicated in Paragraph 2.1.B of this Specifications Section. Apply protective coating in accordance with manufacturer’s instructions.
    c. Where indicated, finish remaining surfaces.

3.6 PATCHING

A. Patching – General:

1. Patch large openings to be filled with concrete in accordance with the Contract Documents. Before installing new concrete, apply bonding adhesive in accordance with manufacture’s recommendations.
2. Where large openings to be filled with concrete are indicated on the Drawings as requiring reinforcing steel, provide reinforcing steel as shown and indicated in the Contract Documents. Where openings in existing reinforced concrete are larger than 2 feet in diameter or 2 feet by 2 feet and the Drawings or elsewhere in the Contract Documents do not expressly require reinforcing steel for the opening, submit a request for interpretation to Engineer and obtain Engineer’s response before proceeding.
3. Where concrete infill or grout repair materials are not used, patch using epoxy patch material indicated in Paragraph 2.1.D of this section unless otherwise indicated on Drawings.
4. Patch construction by filling, repairing, refinishing, closing-up, and similar operations following performance of other Work.
5. Patch with durable seams that are as inconspicuous as possible. Provide materials and comply with installation requirements indicated in the Contract Documents and the published installation instructions of the material’s manufacturer.
6. Patch to provide airtight and watertight connections to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
7. Where feasible, test patched areas to demonstrate integrity of installation.

B. Restoration:

1. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that eliminates evidence of patching and refinishing.
2. For continuous surfaces, refinish to nearest intersection.
3. For an assembly, refinish the entire unit that was patched.
4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 CLEANING

A. Cleaning and Restoration:

1. Perform cleaning promptly after associated cutting, coring, and patching.
2. Clean areas and spaces where cutting, coring, or patching were performed.
3. Clean piping, conduit, and similar constructions before applying paint or other finishing materials.
4. Restore damaged coverings of pipe and other utilities to original condition.

END OF SECTION

SECTION 01 74 00
CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for keeping the Site free of accumulations of waste materials during construction ("progress cleaning").
   2. Cleaning for Substantial Completion and prior to final inspection (collectively, "closeout cleaning").

B. Scope:
   1. Contractor shall perform cleaning during the Project, including progress cleaning, as condition precedent to Substantial Completion, upon completion of the Work, and as required by the General Conditions, as may be modified by the Supplementary Conditions, this Specifications section, and elsewhere in the Contract Documents.
   2. Maintain in a clean manner the Site, the Work, and areas adjacent to or affected by the Work.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Fire Protection Association (NFPA):
      a. 241, Safeguarding Construction, Alteration, and Demolition Operations.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. Progress Cleaning – General:
   1. Clean the Site, work areas, and other areas occupied by Contractor not less than weekly. Dispose of waste materials in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and the following:
      a. Comply with NFPA 241 for removing combustible waste materials and debris.
      b. Do not hold non-combustible materials at the Site more than three days if the ambient air temperature is expected to rise above 80 degrees F. When ambient air temperature is less than 80 degrees F, dispose of non-combustible materials within seven days of their generation.
      c. Provide suitable containers for storage of waste materials and debris. Avoid generation of odors and creation of nuisances.
      d. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately.

B. Progress Cleaning – Site:
   1. Keep outdoor, dust-generating areas wetted down or otherwise control dust emissions.
   2. Not less than weekly, brush-sweep roadways and paved areas at the Site and adjacent areas used by construction vehicles or otherwise affected by construction activities.
   3. Comply with City dust control requirements.

C. Progress Cleaning – Work Areas:
   1. Clean areas where the Work is in progress to maintain an extent of cleanliness necessary for proper execution of the Work and safety of personnel.

2. Remove liquid spills promptly. Where spills may have harmful effects on health, safety, protection of facilities, or the environment, immediately report spills to City, Engineer, and authorities having jurisdiction, in accordance with the Contract Documents and Laws and Regulations.
3. Where dust would impair proper execution of or quality of the Work, broom-clean or vacuum entire work area, as necessary.
4. Concealed Spaces: Remove waste material and debris from concealed spaces before enclosing the space.

D. Progress Cleaning – Installed Work:
1. Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of installed materials and equipment, using only cleaning agents and methods specifically recommended by material or equipment Supplier.
2. If Supplier does not recommend specific cleaning agents or methods, use cleaning agents and methods that are not hazardous to health and property and that will not damage or mar exposed surfaces.

E. Progress Cleaning – Exposed Surfaces:
1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

F. Progress Cleaning – Cutting and Patching:
1. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, trailings and cuttings, and similar materials.
2. Comply with Section 01 73 29 - Cutting and Patching, regarding cleaning during and after cutting and patching Work.
3. Thoroughly clean piping, ductwork, conduits, and similar features before applying patching material, paint, or other finishing materials.
4. Restore damaged insulation and coverings on piping, cutwork, and similar items to its pre-construction condition.

G. Waste Disposal:
1. Properly dispose of waste materials (including surplus materials, debris, rubbish, and other waste) off the Site.
2. Do not burn or bury waste materials at the Site.
3. Remove waste material and rubbish from excavations before backfilling.
4. Do not discharge volatile or hazardous substances, such as mineral spirits, oil, or paint thinner, into storm sewers, gutters, sanitary sewers, or other location in the environment. Dispose of such materials in accordance with Laws and Regulations.
5. Do not discharge wastes to surface waters, drainage routes, or groundwater.
6. Contractor is solely responsible for complying with Laws and Regulations regarding storing, transporting, and disposing of waste generated by Contractor's operations or brought to the Site by Contractor.

H. During handling and installation of materials and equipment, clean and protect construction in progress and adjoining materials and equipment already in place. Apply protective covering where necessary or required for protection from damage or deterioration, until Substantial Completion.

I. Clean completed construction as frequently as necessary throughout the construction period.

3.2 CLOSEOUT CLEANING

A. Complete the following prior to requesting inspection for Substantial Completion:
1. Clean and remove from the Site waste material (including rubbish and debris) and other foreign and undesirable items and substances.
2. Sweep broom-clean paved areas suitable for access by vehicles.
3. Remove spills and stains or petroleum, oils, solvents, other chemicals, and other foreign and undesirable deposits.
4. Hose-clean sidewalks and loading areas.

5. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
6. Surface waterways and drainage routes (including storm sewers, gutters, and ditches) shall be open and clean.
7. Repair pavement, roads, sod, and other areas affected by construction operations and restore to specified condition; if condition is not specified, restore to preconstruction condition.
8. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of spatter, grease, stains, fingerprints, films, and similar foreign and undesirable substances.
9. Remove waste material and surface dust from limited-access spaces, including roofs, plenums, shafts, trenchway, equipment vaults, manholes, and similar spaces.
10. In unoccupied spaces, sweep concrete floors broom-clean.
11. Remove non-permanent tags and labels.
12. Surface Finishes:
    a. Touch-up and otherwise repair and restore chipped, scratched, dented or otherwise marred surfaces to specified finish and match adjacent surfaces.
    b. Do not paint over "UL" or similar labels, including mechanical and electrical nameplates.
13. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign or undesirable substances.
14. Leave the Site clean, and in neat, orderly condition, satisfactory to City and Engineer.

B. Complete the following prior to requesting final inspection:
1. After Substantial Completion of all the Work, following completion of items of incomplete or damaged Work ("punch list Work"), clean "punch list Work areas in accordance with Paragraph 3.2.A of this Specifications Section.
2. Remove field offices, Contractor's storage sheds, and remaining stockpiles and clean all such areas in accordance with Paragraph 3.2.B of this Specifications Section, and in accordance with Contract Documents for landscaping and restoration.

END OF SECTION

SECTION 01 75 00
CHECKOUT AND START-UP PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for checkout and startup of equipment, systems, and facilities.

B. Scope:
   1. Contractor shall initially check out, start up, and place equipment and systems installed under the Contract into successful operation, in accordance with the material and equipment manufacturers' written instructions, Suppliers' recommendations at the Site, and the Contract Documents.
   2. Provide the following:
      a. All labor, tools, materials, and equipment required to complete equipment and system checkout and startup.
      b. Fuel, electricity, water, and other temporary utilities and temporary facilities necessary for checkout and startup of equipment and systems, unless otherwise specified.
   3. The General Conditions, as may be modified by the Supplementary Conditions, and Section 01 77 19 - Closeout Requirements, address requirements for documenting Substantial Completion.

C. Related Sections include but are not necessarily limited to:
   1. Section 01 77 19 - Closeout Requirements.
   2. Section 01 79 23 - Instruction of Operations and Maintenance Personnel.
   3. Section 40 61 13 - Process Control Systems - General Requirements.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate checkout and startup with other contractors, as necessary.
   2. Do not start up equipment or system(s) for continuous operation until all components of that equipment item or system, including instrumentation and controls, have been tested to the extent practicable and proven to be operable as intended by the Contract Documents.
   3. Subject to the constraints of this Specifications section, City will furnish sufficient personnel to assist Contractor in starting up equipment and system(s), but responsibility for proper operation of the Work is Contractor's.
   4. Supplier shall be present during checkout, startup, and initial operation, unless otherwise acceptable to Engineer or otherwise required by the Contract Documents.
   5. Do not start up equipment and system(s), without submitting acceptable preliminary operations and maintenance manuals by Contractor in accordance with the Contract Documents.

B. Checkout and Startup Planning Meeting:
   1. Contractor, with appropriate Subcontractors and Suppliers, shall attend and participate in a meeting with City, facility manager, and Engineer to discuss planning, scheduling, and coordination of checkout and startup activities.
   2. Upon mutual concurrence of City, facility manager, Engineer, and Contractor, meeting may be concurrent with the training scheduling planning meeting required in Section 01 79 23 – Instruction of Operations and Maintenance Personnel.
   3. Meeting shall be held by the earlier of: (1) not less than 60 days prior to first scheduled training session for the equipment and system(s) to be checked out and started-up, and (2) not less than 60 days prior to the checkout and startup of the associated equipment and system(s).

4. Attend meeting prepared to knowledgably and effectively discuss:
    a. Status of the Work and schedule-to-complete for requirements prerequisite to checkout and startup.
    b. Schedule for and status of training required for each equipment item and system.
    c. Schedule for checkout, startup, and field quality control activities for the subject Work.
    d. Status and quantities of required consumables, lubricants, and utility services necessary for checkout and startup.
5. Meeting will be chaired by Engineer. Engineer will prepare and distribute a record of topics discussed and decisions made during the meeting. If meeting is concurrent with the training planning meeting required under Section 01 79 23 - Instruction of Operations and Maintenance Personnel, Contractor shall chair and prepare minutes of the training scheduling planning portion of the meeting and furnish its draft minutes to Engineer to incorporate into the overall minutes.
6. Comply with decisions made at the meeting and the Contract Documents.

C. Scheduling:
1. Progress Schedule:
    a. Clearly indicate in the Progress Schedule planned and actual dates for checkout, startup, and field quality control activities, including all demonstration testing activities addressed in this Specifications section and elsewhere in the Contract Documents. Separately indicate checkout, startup, and field quality control activities for each equipment item and system.
    b. Perform startup and field quality control activities on the associated, scheduled dates, unless otherwise acceptable to City, facility manager, and Engineer.
2. Restrictions for Scheduling:
    a. Checkout of materials, equipment, and systems by Contractor that do not involve or require City's or facility manager's personnel may be performed at any time during normal working hours. Where required by the Contract Documents or requested by Engineer, perform checkout in the presence of Engineer or Resident Project Representative (RPR).
    b. Startup, including initial operation of materials, equipment, and systems, shall not be initiated on: Monday, Friday, Saturday, Sunday, City's holidays, the day immediately prior to a holiday, or the day immediately following a holiday, unless otherwise acceptable to City, facility manager, and Engineer.
    c. Unless otherwise indicated in the Contract Documents or acceptable to City, facility manager, and Engineer, perform all startup during normal working hours of the day shift.
    d. To the extent practicable, where extended-duration startup or field quality control activities are required by the Contract, avoid having such activities extend into evening, night, weekend, or holiday hours.
    e. City reserves the right to require a minimum seven days' notice of rescheduled startup when Contractor cannot perform the associated activities as scheduled.
    f. Coordinate with construction activities related to the Persigo WWTP Expansion project.
3. Operation and Maintenance Data:
    a. A preliminary copy of all operation and maintenance manuals shall be received by Engineer prior to the start of the demonstration period.
4. Training:
    a. Comply with Section 01 79 23 - Instruction of Operations and Maintenance Personnel.
5. Spare Parts, Tools, and Extra Materials.
    a. Deliver to City or facility manager (as applicable) all required spare parts, tools, and extra materials prior to commencing the demonstration period, unless earlier delivery is required elsewhere in the Contract Documents.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Do not start up equipment or systems or place into initial operation until required operating permits are obtained from authorities having jurisdiction.
2. Where City (with or without assistance of Engineer) has applied for and obtained initial approvals or permits necessary for operation, Contractor shall furnish information and assistance to City or Engineer for City to secure final approvals from authorities having jurisdiction for required operating permits.

B. Qualifications:

1.4 DEFINITIONS

A. The following defined terms are used in this Specifications Section:
1. Instrumentation Supplier: Entity retained by Contractor, Subcontractor, or Supplier to furnish instrumentation or controls that will be part of the completed Work, including manufacturers, manufacturer representatives, wholesalers, retailers, and others, including entities retained to perform systems integration Work.
2. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   a. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
   b. Equipment start-up.
   c. Personnel training.
3. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates product through the facility and starts up and operates the facility, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
1. Data collection and reporting log for each required Demonstration Period.

B. Informational Submittals: Submit the following:
1. Progress Schedules indicating dates for checkout, startup, and field quality control activates.
2. Completed checkout and startup log required in Paragraph 3.2.C of this Specifications section.
3. Manufacturer's installation check letters (also known as Manufacturer’s Field Services Report) required in Paragraph 3.2.C of this Specifications section.
4. Instrumentation Supplier’s Instrumentation Installation Certificate, required in Paragraph 3.2.C of this Specifications section.
5. Letter verifying completion of all pre-demonstration startup activities, required in Paragraph 3.2.C of this Specifications section.
6. Report of data collected during each required Demonstration Period.
7. Qualifications Statements:
   a. Qualifications, including resume’ and copy of license, of Contractor-retained licensed operator.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 CHECKOUT AND STARTUP – GENERAL

A. Facility Startup Divided into Two Periods:
1. Pre-Demonstration Period including:

a. Obtain Engineer's approval or acceptance (as applicable) of Submittals required prior to checkout and startup, including all Shop Drawings, Samples, source quality control (shop testing) Submittals, preliminary operation and maintenance manuals, and other Submittals required by the Contract Documents, other than Submittals that cannot be furnished until after startup.
b. Complete the Work to a point ready for checkout and startup, including operation available in all manual, automatic, and other modes.
c. Checkout and initial field quality control activities that can be performed prior to startup of the equipment or system.
d. Startup of the associated Work.
e. Field quality control activities for the subject Work as indicated elsewhere in the Specifications and other Contract Documents, other than this section.
f. Training of operations and maintenance personnel.

2. Demonstration Period, including:
   a. Demonstration of functional integrity of equipment, system, or PCS.

3.2 PRE-DEMONSTRATION PERIOD

A. Prior to the Pre-Demonstration Period, complete the Work to the point where it is ready for checkout and startup.

B. Checkout.
1. Comply with Section 01 61 03 - Equipment - Basic Requirements, including provisions concerning installation checks.

C. Startup:
1. Comply with requirements for startup of materials, equipment, and systems indicated in the associated Specification sections and elsewhere in the Contract Documents.
2. Prepare the Work so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
3. Perform startup to extent possible without introducing process flow.
4. Procedures include but are not necessarily limited to the following:
   a. Test or check and correct deficiencies of:
      1) Instrumentation and control signal generation, transmission, reception, and response.
         a) Comply with Section 40 61 13 - Process Control System General Requirements.
      2) Tagging and identification systems.
      3) Proper connections, alignment, calibration and adjustment.
   b. Calibrate safety equipment.
   c. Perform other tests, checks, and activities required to make the Work ready for Demonstration Period.
   d. Checkout and Startup Log:
      1) Prepare a log showing each equipment item and system requiring checkout and startup. Indicate in the log activities to be accomplished during checkout and startup.
      2) Provide a place for Contractor to record date and person performing required checkout and startup. Indicate associated date(s), personnel, and employer of each.
      3) Submit completed checkout and startup log to Engineer and obtain Engineer's acceptance.
5. Obtain Suppliers' certifications of the installed and operational Work, without restrictions, and submit to Engineer:
   a. Manufacturer's installation check letters (sometimes referred to as Manufacturer's Field Services Report).
   b. Instrumentation Supplier's Instrumentation Installation Certificate.
6. Letter verifying completion of all pre-demonstration startup activities including receipt of all specified items from Suppliers as final item prior to initiation of Demonstration Period.
7. Personnel Training:

3.3 DEMONSTRATION PERIOD

A. Demonstration Period – General:
   1. Demonstrate the operation and performance of instrumentation and control interfaces of the Work undergoing the Demonstration Period, in accordance with the Contract Documents.
   2. Duration of Demonstration Period: 120 consecutive hours.
   3. If, during the Demonstration Period, the aggregate time used for repair, alteration, or unscheduled adjustments to any part of the Work that renders the affected Work inoperative or operation outside of recommended ranges exceeds 10% of the Demonstration Period, the demonstration of operation and performance will be deemed unacceptable and Contractor shall provide appropriate adjustments and remedies and re-perform the Demonstration Test, at no additional cost to City or facility manager, until acceptable results are obtained. Re-performance of the Demonstration Period shall comply with the same requirements as the original Demonstration Period.
   4. Perform the demonstration of operation and performance of the Work under full operational conditions.
   5. City's or Facility Manager's Personnel:
      a. City or facility manager (as applicable) will make available operations personnel to make process decisions affecting facility performance and compliance with applicable operating permits.
      b. City's or facility manager's assistance will be available only for process decisions.
      c. Contractor will perform all other functions associated with the Demonstration Period including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period in accordance with the Contract Documents.
   6. City or facility manager reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, and similar actions and events during the Demonstration Period to verify the operation and performance of the Work in automatic, manual, and other types of operating modes, backup systems, and alternate operating modes.
   7. Prior to Starting Demonstration Period:
      a. Prepare data collection and reporting log for sampling, analytical data, and data to be obtained by manually recording data from field or panel indicators. Not less than 30 days prior to the start of the Demonstration Period, submit the data collection and reporting log to Engineer for acceptance.
   8. Timing of Start and End of Demonstration Period:
      a. Schedule the end of the Demonstration Period at a convenient time such as midnight, so the City or facility manager can assume operational responsibility on a new day beginning immediately after completion of the Demonstration Period.
      b. Time of beginning and ending Demonstration Period shall be agreed upon by Contractor, City (and facility manager, if other than City), and Engineer in advance of initiating Demonstration Period.

B. Demonstration Period, Evaluation, and Acceptance:
   1. Throughout the Demonstration Period, provide knowledgeable personnel to answer City's or facility manager's questions, provide final field instruction on select systems (where appropriate) and to respond to problems or failures of the Work.
   2. Responsibilities for Data Reporting:
      a. Submit data collected to Engineer for evaluation of acceptability of results.
   3. Data Evaluation:
      a. Engineer, in consultation with City and facility manager (as applicable) as necessary, will evaluate the data collected during the Demonstration Period and other information obtained during the Demonstration Period for compliance with the Contract Documents.
      b. Engineer will advise Contractor in writing of whether the data and information obtained indicate that the Demonstration Period was successfully completed.
   4. Criteria for Acceptance:
      a. Stable and continuous communication between SCADA equipment in the Facility.

END OF SECTION

SECTION 01 77 19
CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for:
   1. Substantial Completion.
   2. Final inspection.
   3. Request for final payment and acceptance of the Work.

1.2 SUBSTANTIAL COMPLETION

A. Substantial Completion – General:
   1. Prior to requesting inspection for Substantial Completion, perform the following for the substantially completed Work:
      a. Materials and equipment for which Substantial Completion is requested shall be fully ready for their intended use, including full operating and monitoring capability in automatic, manual, and other operating modes set forth in the Contract Documents.
      b. Permanent provisions for safety and protection, shown and indicated in the Contract Documents and associated with the substantially completed Work or for personnel accessing and using the substantially completed Work, shall be in place and ready for their intended use.
      c. Complete field quality control Work, including inspections and testing at the Site, indicated in Specifications sections for individual materials and equipment items and related Contract Documents. Submit results of, and obtain Engineer's acceptance of, field quality control tests and inspections required by the Contract Documents.
      d. Complete checkout and startup in accordance with Section 01 75 00 - Checkout and Startup Procedures, requirements of the Specifications for the various materials and equipment in the substantially completed Work, and related Contract Documents.
      e. Cleaning for Substantial Completion shall be completed in accordance with Section 01 74 00 - Cleaning.
      f. Spare parts, tools, and extra materials shall be delivered and accepted in accordance with the Contract Documents and documentation of City's acceptance thereof has been submitted to Engineer in acceptable form.
      g. Training of the facility's operations and maintenance personnel shall be completed in accordance with the Contract Documents, including Section 01 79 23 - Instruction of Operations and Maintenance Personnel.
      h. Obtain and submit to Engineer all required permits, inspections, and approvals of authorities having jurisdiction for the substantially completed Work to be occupied and used by City.
      i. Complete other tasks that the Contract requires be completed prior to Substantial Completion.
   2. Procedures for requesting and documenting Substantial Completion are in the General Conditions, as may be modified by the Supplementary Conditions.
   3. Sample letter for Contractor's request for inspection for Substantial Completion is attached to this Specifications section. Use the model language of the sample letter, modified to suit the Project and the needs of Contractor's request.
   4. Unless decided otherwise by City and Engineer, form of certificate of Substantial Completion will be the "Notice of Substantial Completion" provided by the City with the Agreement , prepared by Engineer.
   5. Refer to the Agreement for requirements regarding consent of surety to partial release of or reduction in retainage.

1.3 FINAL INSPECTION

A. Final Inspection – General:
   1. Prior to requesting final inspection, verify that all the Work is fully complete and ready for final payment. Partial checklist for this purpose is attached to this Specifications section.
   2. Sample letter for Contractor to request final inspection is attached to this Specifications section. Use the model language of the sample letter, modified to suit the Project.
   3. Procedures for requesting and documenting the final inspection are in the General Conditions, as may be modified by the Supplementary Conditions, and as augmented in this Specifications section.

1.4 REQUEST FOR FINAL PAYMENT AND ACCEPTANCE OF THE WORK

A. Procedure:
   1. After successful completion of the final inspection, submit request for final payment in accordance with the Agreement and General Conditions, as may be modified by the Supplementary Conditions, and using procedure specified in the Agreement, and this Specification section.
   2. Acceptance of the Work:
      a. Upon Engineer's concurrence that the Work is complete and ready for final payment (as a result of the final inspection and other communications between the parties and Engineer) and receipt of the final Application for Payment, accompanied by other required Contract closeout documentation, all in accordance with the Contract Documents, Engineer will issue to City and Contractor a notice of acceptability of the Work, in accordance with the General Conditions, as may be modified by the Supplementary Conditions.
      b. Unless decided otherwise by City and Engineer, form of acceptance will be "Notice of Final Acceptance" provided by the City with the Agreement.
      c. Nothing other than receipt of such notice of acceptability from Engineer constitutes acceptance of the Work.
      d. Receipt of Engineer's notice of acceptability of the Work does not relieve Contractor of Contractor's continuing obligations under the Contract, including correction period obligations, warranty obligations, indemnification obligations, insurance requirements, and Contractor's other obligations following acceptance of the Work by Engineer and final payment. Such obligations shall commence and remain in effect as indicated elsewhere in the Contract Documents.

B. Request for final payment shall include:
   1. Documents required for final payment as may be described in these Specifications.
   2. Documents required in the General Conditions, as may be modified by the Supplementary Conditions.
   3. List, on Contractor's letterhead, of all Change Proposals, Claims, and disputes that Contractor believes are unsettled. If there are no such Change Proposals, Claims, or disputes, so indicate in writing.
   4. Consent of Surety to Final Payment:
      a. Acceptable form includes AIA G707, "Consent of Surety to Final Payment" (1994 or later edition), or other form acceptable to City.
   5. Releases of Liens:
      a. Submit complete and legally effective releases (satisfactory to City) of all Liens filed in connection with the Work, regardless of whether such Lien was filed by Contractor, Subcontractor, or Supplier.
      b. Each release of Lien shall be signed by an authorized representative of the entity submitting the release of Lien, and shall include Contractor's, Subcontractor's, or Supplier's (as applicable) corporate seal, when applicable.
   6. Waivers of Lien Rights:

a. Submit legally-binding waivers of rights to file Liens, acceptable to City, as required in the General Conditions (as may be modified by the Supplementary Conditions) from Contractor and each Subcontractor and Supplier that furnished or provided labor, material, or equipment totaling $1,000 or more for the Work.
b. Furnish final list of Subcontractors and Suppliers indicating final amount of the associated subcontract or purchase order for each. Include on the list all lower-tier Subcontractors and Suppliers retained by higher-tier Subcontractors and Suppliers.
c. Each waiver of Lien rights shall be signed by an authorized representative of the entity submitting waiver of Lien rights, and shall include Contractor's, Subcontractor's, or Supplier's (as applicable) corporate seal, when applicable.
d. Waiver of Lien rights may be conditional upon receipt of final payment.
e. Required Affidavits: Submit the following:
    1) Affidavit of payment of debts and claims, submitted by Contractor. Acceptable form includes AIA G706, "Contractor's Affidavit of Payment of Debts and Claims" (1994 or later edition), or other form acceptable to City, and;
    2) Affidavit of release of Liens, submitted by Contractor. Acceptable form includes AIA G706A, "Affidavit of Release of Liens" (1994 or later edition).
    3) Each affidavit shall be signed by an authorized representative of Contractor and shall bear Contractor's corporate seal, as applicable.
f. In the event Contractor is unable to obtain one or more required waivers of Lien rights, recourse is set forth in the General Conditions, as may be modified by the Supplementary Conditions.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The documents listed below, following this Specification section's "End of Section" designation, are part of this Specifications section:
    1. Sample letter for Contractor's use in requesting inspection for Substantial Completion (two pages).
    2. Sample partial checklist to identify readiness for final inspection (four pages).
    3. Sample letter for Contractor's use in requesting final inspection (one page).

B. In the model language of the attached sample letters for Contractor to request inspection for Substantial Completion and the final inspection, italicized language in brackets, e.g., "[insert date]" indicates instructions to the drafter of the letter and often indicates specific information to be inserted by Contractor; do not include bracketed, italicized text in the final version of the letter(s) prepared for the Project. Non-italicized language in brackets is optional language; use the appropriate language to complete the actual letter for the Project and edit where required to suit the specific circumstances.

END OF SECTION

SAMPLE LETTER FOR CONTRACTOR'S USE IN REQUESTING INSPECTION FOR SUBSTANTIAL COMPLETION

SENT VIA E-MAIL AND U.S. CERTIFIED MAIL/RETURN RECEIPT REQUESTED

[Date]

[Name of Engineer's contact person]
HDR
[Street address]
[City, state, postal code]

Subject:
[Project name, Contract designation]
Request for Inspection for Substantial Completion

Dear [addressee]:

In our opinion, [all of] [or] [a portion of] the Work under the above-referenced Contract is substantially complete as of [insert month, day, year on which Substantial Completion was achieved]. [The specific portion of the Work that we believe is substantially complete is [insert identification of that portion of the Work that is substantially complete].]

Enclosed is our listing of uncompleted Work items ("punch list"). In accordance with Paragraph 15.03.A of the General Conditions, we hereby request: (1) That the Engineer schedule and perform the inspection for Substantial Completion as soon as possible, and (2) Issuance of the certificate of Substantial Completion.

In accordance with the General Conditions, upon Substantial Completion, we propose the following relative to apportionment of responsibilities between the City and the Contractor:

1. Security, Protection, Insurance:
    a. Site Security: [insert proposal; address whether City or Contractor will be responsible for security of the Site].
    b. Protection of the Substantially Completed Work: [insert proposal; address whether City or Contractor will be responsible for protection].
    c. Property Insurance: [insert proposal; typically City assumes responsibility for property insurance upon Substantial Completion]
2. Operation and Maintenance:
    a. Operation: [insert proposal; address whether City or Contractor will be responsible for operating the substantially completed Work].
    b. Maintenance: [insert proposal; address whether City or Contractor will be responsible for maintaining the substantially completed Work].
3. Utilities: [for each of the following, indicate whether City or Contractor will be responsible for utilities and services, or whether responsibility will be shared; if shared, indicate proposed cost-sharing]
    a. Electricity: [insert proposal].
    b. Natural Gas/Fuel/Heating: [insert proposal].
    c. Water Supply: [insert proposal].

d. Wastewater: [insert proposal].

e. Communications (Telephone, Internet, Video): [insert proposal].

In accordance with Paragraph 15.08.A of the General Conditions, we understand that the Contract's correction period for the Work covered by the certificate of Substantial Completion commences on the Substantial Completion date documented in said certificate. [Drafter: Also see Paragraph 15.04 ("Partial Utilization") of the General Conditions and, where necessary, edit this paragraph of the letter accordingly.]

Should you have questions or comments regarding this notice, please contact [the undersigned] [or] [insert other contact person's name], at [insert telephone number and e-mail address].

Sincerely,

[Contractor's company name]

[Signatory name]
[Signatory's title]

Attachments:
Preliminary list of uncompleted Work items ("punch list"; [##] pages)

Copies:
[City's project manager]

SAMPLE PARTIAL CHECKLIST TO IDENTIFY READINESS FOR FINAL INSPECTION

Project: [_____]
Contract: [_____]
Contractor: [_____]

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
1. All Submittals, including all Shop Drawings and Samples, approved or accepted by Engineer	☐		☐	☐	☐		
Remarks:							
1. Final services completed by Suppliers, including submittal of "Manufacturer Field Service Report" in Section 01 61 03 Equipment - Basic Requirements	☐		☐	☐	☐		
Remarks:							
2. Final Work completed by Subcontractors	☐		☐	☐	☐		
Remarks:							
3. Permits closed out and regulatory compliance transitioned from construction to operations	☐		☐	☐	☐		
Remarks:							
4. All outstanding change issues are addressed and all Change Proposals submitted	☐		☐	☐	☐		
Remarks:							
5. All Change Proposals and Claims are resolved	☐		☐	☐	☐		

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
Remarks:							
6. All defective Work of which Contractor is aware has been corrected in accordance with the Contract Documents	☐		☐	☐	☐		
Remarks:							
7. Issues related to Constituents of Concern and potential Hazardous Environmental Condition have been fully addressed	☐		☐	☐	☐		
Remarks:							
8. All spare parts, tools, and extra materials have been furnished in accordance with the Contract Documents, and documentation thereof submitted to Engineer	☐		☐	☐	☐		
Remarks:							
9. All final operations & maintenance manuals have been submitted and accepted by Engineer	☐		☐	☐	☐		
Remarks:							
10. Manufacturer warranties and software license(s) furnished	☐		☐	☐	☐		
Remarks:							
11. Instruction and training of operations and maintenance personnel is complete and records of training submitted	☐		☐	☐	☐		

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
Remarks:							
12. MBE/WBE/DBE/VBE compliance report(s) submitted (when applicable)	☐		☐	☐	☐		
Remarks:							
13. All field engineering Submittals, including survey data, furnished	☐		☐	☐	☐		
Remarks:							
14. All Work on "punch list" is complete in accordance with the Contract Documents	☐		☐	☐	☐		
Remarks:							
15. All record documents submitted to and accepted by Engineer	☐		☐	☐	☐		
Remarks:							
16. Contractor is fully demobilized from the Site	☐		☐	☐	☐		
Remarks:							
17. All Site restoration is complete	☐		☐	☐	☐		
Remarks:							
18. Final cleaning of all work areas is complete	☐		☐	☐	☐		
Remarks:							
19. Releases of Liens and waivers of Lien rights (or acceptable	☐		☐	☐	☐		

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
alternative) obtained from Subcontractors and Suppliers							
Remarks:							
20. Evidence of Contractor liability insurance furnished for correction period	☐		☐	☐	☐		
Remarks:							
21. All other required Contract closeout documents obtained	☐		☐	☐	☐		
Remarks:							
Remarks:							
22. All other Work and documentation required prior to final payment is complete and provided in accordance with the Contract Documents	☐		☐	☐	☐		
Remarks:							

SAMPLE LETTER FOR CONTRACTOR'S USE IN REQUESTING FINAL INSPECTION

SENT VIA E-MAIL AND U.S. CERTIFIED MAIL/RETURN RECEIPT REQUESTED

[Date]

[Name of Engineer's contact person]
HDR
[Street address]
[City, state, postal code]

Subject:
[Project name, Contract designation]
Request for Final Inspection

Dear [addressee]:

The Work under the above-referenced Contract is complete and ready for final payment as of [insert month, day, year on which final completion was achieved]. In accordance with Paragraph 15.05 of the General Conditions, we hereby request that the Engineer schedule and perform the final inspection as soon as possible. Upon successful completion of the final inspection, we will submit our final Application for Payment accompanied by the required Contract closeout documentation in accordance with the Contract Documents.

Should you have questions or comments regarding this notice, please contact [the undersigned] [or] [insert other contact person's name], at [insert telephone number and e-mail address].

Sincerely,

[Contractor's company name]

[Signatory name]
[Signatory's title]

Attachments:
None

Copies:
[City's project manager]

SECTION 01 78 36
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for warranties required in the various Specifications.
   2. Provisions addressing:
      a. Suppliers' standard warranties.
      b. Suppliers' special or extended warranties.
      c. Implied warranties.
      d. Commencement and duration of warranties.

1.2 SUBMITTALS

A. General:
   1. For each item of equipment furnished under the Contract, submit Supplier's standard warranty, regardless of whether such warranty or Submittal thereof is required by the associated Specifications for that item. Submit such warranties for materials where such Submittal is required in the Specifications for the material.
   2. For each item of material or equipment where Supplier's special (or extended) warranty is required by the Contract Documents, submit appropriate special warranty that complies with the Contract Documents.
   3. Supplier's warranties shall be specifically endorsed to City, Contractor, and the entity purchasing the item (if other than Contractor) by the entity issuing such warranty.
   4. Submit Suppliers' standard warranties and special warranties as Submittals in accordance with the Schedule of Submittals accepted by Engineer.

1.3 CONTRACTOR'S GENERAL WARRANTY AND CORRECTION PERIOD OBLIGATIONS

A. Contractor's General Warranty and Guarantee: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

B. Contractor's Warranty of Title: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

C. Correction Period: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

1.4 SUPPLIERS' WARRANTIES FOR MATERIALS AND EQUIPMENT

A. Warranty Types:
   1. Required by the General Conditions:
      a. Warranties specified for materials and equipment shall be in addition to, and run concurrent with, Contractor's general warranty and guarantee and requirements for the Contract's correction period.
      b. Disclaimers and limitations in specific materials and equipment warranties do not limit Contractor's general warranty and guarantee, nor does such affect or limit Contractor's performance obligations under the correction period.
   2. Material or equipment manufacturer's standard warranty is pre-printed, written warranty published by item's manufacturer and specifically endorsed by manufacturer to the entities indicated in this Specifications Section's Article 1.2.

3. Special warranty is written warranty that either extends the duration of material or equipment manufacturer's standard warranty or provides other, increased rights to City and other beneficiaries (if any) of such warranty. Where the Contract Documents indicate specific requirements for warranties that differ from the manufacturer's standard warranty for that item, special warranty is implied.

B. Requirements for Special Warranties:
   1. Submit written special warranty document that contains appropriate provisions and identification, ready for signature by material or equipment manufacturer, City, and other beneficiaries indicated in Article 1.2 of this Specifications Section. Submit draft warranty with Submittals required prior to fabrication and shipment of the item from the Supplier's facility.
   2. Manufacturer's Standard Form: Modified to include Project-specific information and properly signed by product manufacturer and other entities as appropriate.
   3. Specified Form: When specified forms for special warranties are included in the Contract Documents, prepare written document, properly signed by item manufacturer, City, and other beneficiaries indicated in Article 1.2 of this Specifications Section, using the required form.
   4. Refer to the Specifications for content and requirements for submitting special warranties.

1.5 IMPLIED WARRANTIES

A. Warranty of Title and Intellectual Property Rights:
   1. Except as may be otherwise indicated in the Contract Documents, implied warranty of title required by Laws and Regulations is applicable to the Work and to materials and equipment incorporated therein.
   2. Provisions on intellectual property rights, including patent fees and royalties, are in the General Conditions, as may be modified by the Supplementary Conditions.

B. Warranty of Merchantability:
   1. Notwithstanding any other provision of the Contract to the contrary, implied warranties of merchantability required by Laws and Regulations apply to the materials and equipment incorporated into the Work.

C. Warranty of Fitness-for-Purpose:
   1. Implied warranty of fitness-for-purpose for materials and equipment to be incorporated into the Work, for which specific material or features are indicated in the Contract Documents, is hereby disclaimed by City and Contractor.
   2.
   3. When Supplier is aware of, or has reason to be aware of, specified materials or features of the Work that are contrary to the intended use, purpose, service, application, or environment in which the material or item will be used, submit request for interpretation. Where appropriate, such request for interpretation shall indicate the apparent discrepancy and propose appropriate, alternative materials or equipment.

1.6 COMMENCEMENT AND DURATION OF WARRANTIES

A. Commencement of Warranties:
   1. Contract correction period and Contractor's general warranty commence as indicated in the General Conditions, as may be modified by the Supplementary Conditions.
   2. Suppliers' standard warranties and special warranties commence running on the date that the associated item is certified by Engineer as substantially complete in accordance with the Contract Documents. In no event shall special warranties commence running prior to Engineer's review and acceptance of special warranty Submittal for the item.
   3. Implied warranties commence in accordance with Laws and Regulations.

B. Duration of Warranties:
   1. Duration of correction period is set forth in the General Conditions, as may be modified by the Supplementary Conditions.

2. Duration of Contractor's general warranty and guarantee is in accordance with Laws and Regulations.
3. Duration of Suppliers' standard warranties is in accordance with the applicable standard warranty document accepted for the Project by Engineer.
4. Duration of required Suppliers' special warranties shall be in accordance with the requirements of the Contract Documents for the subject item.
5. Duration of implied warranties shall be in accordance with Laws and Regulations.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for Project record documents, to supplement record documents requirements of the General Conditions, as may be modified by the Supplementary Conditions.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, and services to establish, maintain, continuously update, and submit to Engineer Project record documents in accordance with the Contract Documents.

C. Related Sections include but are not necessarily limited to:
   1. Section 01 31 26 - Electronic Communication Protocols.
   2. Division 01 Specifications

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain necessary field measurements and record all data required for Project record documents before covering up the Work or building on subsequent phases of the Work.
   2. Promptly after obtaining measurements and information, record the data and information on Project record documents.
   3. Where a licensed, registered professional land surveyor is retained on the Project, whether by Contractor or others, to perform field measurements and record other data for as-constructed Project or Site conditions, coordinate with such entity and schedule and perform the Work accordingly. Allow surveyor sufficient time and proper conditions for performing surveyor's work. Assist the surveyor as necessary in performance of surveyor's responsibilities.

B. Monthly Status Evaluation:
   1. Not less than once per month, as a condition precedent to submitting Application for Payment, Contractor's site superintendent will meet with either Engineer or Owner's Site Representative (OSR) at the Site to review status of Contractor's Project record documents.
   2. When Engineer or OSR directs corrections to Project record documents, promptly make such corrections on the Project record documents. Engineer's or OSR's directions or lack thereof do not in any way relieve or mitigate Contractor's sole responsibility for the accuracy, completeness, and clarity of Project record documents.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Recorder of Changes and Field Conditions on Project Record Documents:
      a. Contractor's staff at the Site shall include not less than one person with suitable training and drafting (drawing) experience to record on the Project record documents changes made and field conditions encountered.
      b. Recorder of changes and field conditions on the Project record documents shall possess not less than two semesters of drafting (drawing) training in a classroom, either in high school, college, or bona-fide vocational school.
      c. Upon Engineer's request, submit name of proposed recorder at the Site, resume', or list of relevant experience, and copy of credentials of completion of such drafting (drawing) course(s).

d. If original recorder of changes and field conditions is replaced, promptly advise Engineer and OSR in writing and submit to Engineer qualifications of proposed replacement.

B. Samples of Similar Prior Work:
1. Submit Samples of the personal work of Contractor's designated recorder of changes and field conditions on the Project record documents from not less than two prior projects of similar type(s) of work at the Work. Submit copies of not less than two marked-up drawings from each prior project and copies of two pages of marked-up specifications from each prior project.
2. Samples shall be in the same form as proposed for the Project record documents. For example, where Contractor intends to submit hand-drawn mark-ups of the Drawings and Specifications, Samples shall be copies of hand-drawn markups. Where Contractor intends to submit Project record documents in native (executable) file format (such as CAD files), Samples shall be developed using the same software to be used in preparing the Project record documents.
3. If original recorder of changes and field conditions is replaced by Contractor, replacement recorder shall provide the same standard of work on Project record documents as indicated in the approved Samples.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Samples:
a. Sample of field-recorded project record documents from prior projects, in accordance with this Specifications section's "Quality Assurance" Article, to establish quality and style for markups of Project record documents. Submit within 15days of the date the Contract Times commence running.

B. Informational Submittals: Submit the following:
1. Qualifications Statements:
a. When requested by Engineer, submit qualifications of proposed recorder of changes and field conditions for Project record documents at Contractor's field office at the Site. Qualifications shall comply with the "Quality Assurance" Article of this Specifications section.

C. Closeout Submittals: Submit the following:
1. Record Documentation:
a. Prior to readiness for final payment, submit to Engineer one copy of Project's final record documents and obtain Engineer's acceptance of same. Submit complete record documents; do not make partial Submittals without Engineer's concurrence.
b. Submit the following Project record documents:
1) Record Drawings, including those issued via Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.
2) Record project manual, including Specifications, indicating changes made via Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.
c. Submit record documents with transmittal letter on Contractor's letterhead in accordance with requirements in Section 01 33 00 - Submittal Procedures.
2. Certifications:
a. Record documents Submittal shall include certification, with original signature of official authorized to sign legally-binding contracts on behalf of Contractor, reading as follows:

1) (Contractor's legal/contractual entity name) has maintained, continuously updated, and submitted Project record documentation in accordance with the General Conditions and Supplementary Conditions, Section 01 78 39 - Project Record Documents, and other elements of Contract Documents, for the City of Grand Junction, Colorado. Persigo WWTP Internal Fiber Optic Loop project. We certify that each record document submitted is complete, accurate, and legible relative to the Work performed under our Contract, and that the record documents comply with the requirements of the Contract Documents.

By: _____(signature)
Print Name: _____
Title: _____

1.5 MAINTENANCE OF RECORD DOCUMENTS

A. Maintain in Contractor's field office, in clean, dry, legible condition, complete sets of the following record documents:
   1. Drawings, Specifications, and Addenda;
   2. Shop Drawings, Samples, and other Submittals, including records of test results, approved or accepted as applicable, by Engineer;
   3. Change Orders, Work Change Directives, Field Orders, allowance authorizations;
   4. Copies of all interpretations and clarifications issued;
   5. Photographic documentation;
   6. Survey data; and
   7. All other documents pertinent to the Work.

B. Provide files and racks for proper storage and easy access to Project record documents. File record documents in accordance with the edition of the Construction Specification Institute's *MasterFormat* used for organizing the project manual, unless otherwise accepted by Engineer or City.

C. Promptly make Project record documents available for observation and review upon request of Engineer or City.

D. Do not use Project record documents for any purpose other than serving as Project record. Do not remove Project record documents from Contractor's field office without Engineer's approval.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

A. Recording Changes, Field Conditions, and Other Information – General:
   1. At the start of the Project, label each record document to be submitted as, "PROJECT RECORD" using legible, printed letters. Letters on record copy of the Drawings shall be two inches high.
   2. Keep record documents current consistent with the progress of the Work. Make entries on record documents within two working days of receipt of information required to record the change, field condition, or other pertinent information.
   3. Do not permanently conceal the Work until required information has been recorded for Project record documents.
   4. Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from Engineer-accepted Project record documents.
   5. Marking of Entries:
      a. Use erasable, colored pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to Project record documents.
      b. Clearly describe the change by graphic line and make notations as required. Use straight-edge to mark straight lines. Writing shall be legible and sufficiently dark to allow scanning of record documents into legible electronic files in "portable document format" (.PDF) files.

c. Date each entry on record documents.
d. Indicate changes by drawing a “cloud” around the change(s) indicated.
e. Mark initial revisions in red. In the event of overlapping changes, use different colors for subsequent changes.

B. Drawings:
1. Record changes on copy of the Drawings. Submittal of Contractor-originated or -produced drawings as a substitute for recording changes on a copy of the Drawings is unacceptable.
2. Record changes on plans, sections, elevations, schematics, schedules, and details as required for clarity, accuracy, and completeness, making reference dimensions and elevations (to Project datum) for complete record documentation.
3. Record actual construction including:
a. Depths of various elements of foundation relative to Project datum.
b. Horizontal and vertical location of Underground Facilities referenced to permanent surface improvements and Project elevation datum. For each Underground Facility, including pipe fittings, show and indicate dimensions to not less than two permanent, visible surface improvements.
c. Location of exposed utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure and, where applicable, to Project elevation datum.
d. Changes in structural and architectural elements of the Work, including changes in reinforcing.
e. Field changes of dimensions, arrangements, and details.
f. Changes made in accordance with Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.
g. Changes in details on the Drawings. Submit additional details prepared by Contractor when required to document such changes.
4. Recording Changes for Schematic Layouts:
a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items are shown schematically and are not intended to portray physical layout. For such cases, the final physical arrangement shall be determined by Contractor subject to acceptance by Engineer.
b. Record on the Project record documents all revisions to schematics on the Drawings, including: piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, motor control center layouts, and other schematics when included in the Drawings. Show and indicate actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.
c. When dimensioned plans and dimensioned sections or elevations on the Drawings show the Work schematically, indicate on the Project record documents, by dimensions accurate to within one inch in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items
1) Clearly identify each item of the Work by accurate notations such as “cast iron drain”, “rigid electrical conduit”, “copper waterline”, and similar descriptions.
2) Show by symbol or by note the vertical location of each item of the Work; for example, “embedded in slab”, “under slab”, “in ceiling plenum”, “exposed”, and similar designations. For piping not embedded, also indicate elevation dimension relative to Project elevation datum.
3) Descriptions shall be sufficiently detailed to be related to the Specifications.
d. Engineer may furnish written waiver of requirements relative to schematic layouts shown on plans, sections, and elevations when, in Engineer’s judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on such waiver(s) being issued.
5. Supplemental Drawings:

a. In some cases, drawings produced during construction by Engineer or Contractor supplement the Drawings and shall be included with Project record documents submitted by Contractor. Supplemental record drawings shall include drawings or sketches that are part of Change Orders, Work Change Directives, Field Orders, and allowance authorizations and that cannot be incorporated into the Drawings because of space limitations.
b. Supplemental drawings submitted with record drawings shall be integrated with the Drawings and include necessary cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.
c. When supplemental drawings developed by Contractor using computer-aided drafting/design (CAD), building information models (BIM), or civil information models (CIM) software are to be included in record drawings, submit electronic files for such drawings in accordance with Section 01 31 26 – Electronic Communication Protocols, as part of record drawing Submittal. Label such files, "Supplemental Record Drawings", including with Contractor's name, Project name, and Contract designation.

C. Specifications and Addenda:
1. Mark each Specifications section to record:
a. Manufacturer, trade name, catalog number, and Supplier of each material and equipment item actually furnished.
b. Changes made by Addendum, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.

1.7 ELECTRONIC DOCUMENTS FURNISHED BY ENGINEER

A. CAD, BIM, or CIM files of the Drawings will be furnished by Engineer upon the following conditions:
1. Contractor shall submit to Engineer a letter on Contractor letterhead requesting CAD, BIM, or CIM files of the Drawings and indicating specific definition(s) or description(s) of how such Electronic Documents will be used by Contractor, and specific description of benefits to City (including credit proposal, if applicable) if the request is granted.
2. Engineer does not guarantee that Electronic Documents are available in the format(s) requested by Contractor. Some projects may have Drawings developed using only CAD software instead of BIM or CIM software. Engineer will not create BIM or CIM files for Contractor if such files do not already exist.
3. Contractor shall sign Engineer's standard agreement with Contractor for release of Electronic Documents and shall abide by the provisions of such agreement for release of Electronic Documents.
4. Layering system incorporated in CAD, BIM, and CIM files shall be maintained as transmitted by Engineer. CAD, BIM, and CIM files transmitted by Engineer containing cross-referenced files shall not be bound by Contractor. Drawing cross-references and paths shall be maintained. If Contractor alters layers or cross-reference files, Contractor shall restore all layers and cross-references prior to submitting Project record documents to Engineer.
5. Contractor shall submit Project record drawings to Engineer in same CAD, BIM, or CIM format that files were furnished to Contractor.

B. Microsoft Word files of Specifications:
1. Requirements for Engineer's potential release of word processing files of the Specifications or other written documents in native format are the same as those for Drawings.
2. When Specifications are released in native format, Contractor shall submit record specifications in the same format, with all changes tracked using Microsoft Word's "track changes" feature.
3. Do not modify the formatting of the native files furnished by Engineer. If formatting changes are made without Engineer's authorization, remedy the formatting to the same condition and status as when the files were first delivered to Contractor. Such remedy shall be at Contractor's expense.
4. Comply with all requirements of this Specifications section regarding record specifications.

5. After delivery of record specifications Submittal to Engineer, delete from Contractor's files the native word processing files. Contractor may retain a PDF version of such files for Contractor's records.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 79 23
INSTRUCTION OF OPERATION AND MAINTENANCE PERSONNEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Administrative and procedural requirements for instruction of operation and maintenance personnel.
2. Qualifications requirements for Suppliers' training personnel.
3. General requirements for training.
4. Schedule of required training sessions.

B. Scope:
1. Contractor shall furnish services of Suppliers' operation and maintenance training specialists to instruct City's personnel in recommended operating and maintenance procedures for materials and equipment furnished, in accordance with the Contract Documents.
2. Each Supplier shall provide a combination of classroom and field training at the Site, unless otherwise required elsewhere in the Contract Documents.
City or facility manager reserves the right to record training sessions on video for City's or facility manager's later use in instructing City's or facility manager's personnel.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling of Training Sessions:
1. General:
a. Contractor shall coordinate training services with checkout, startup, and initial operation of materials and equipment on days and times, and in manner, acceptable to City in accordance with the Contract Documents.
b. Training may be required outside of normal business hours to accommodate schedules of operation and maintenance personnel. Provide training services at the required days and times at no additional cost to City.
2. Prerequisites to Training:
a. Training of facility operation and maintenance personnel shall commence after preliminary operation and maintenance data has been submitted and accepted by Engineer, and the Work required in Section 01 75 00 - Checkout and Startup Procedures, is complete.
b. At option of City or Engineer, training may be allowed to take place before, during, or after checkout and startup of materials and equipment.
3. Training Schedule Submittal:
a. Training Schedule Required: Contractor shall prepare and submit proposed training schedule for review and acceptance by Engineer and City. Proposed training schedule shall show and indicate all training required in the Contract Documents, and shall demonstrate compliance with specified training requirements relative to number of hours of training for various elements of the Work, number of training sessions, and scheduling.
b. Timing of Training Schedule Submittal: Submit initial training schedule not less than 60 days before scheduled start of first training session. Submit final training schedule, incorporating revisions in accordance with Engineer's comments, not later than 30 days prior to starting the first training session.

c. City reserves the right to modify personnel availability for training in accordance with process or emergency needs at the facility.

B. Training Scheduling Conference:
1. Prior to preparing initial training schedule Submittal, schedule and hold training scheduling conference at the location where progress meetings are held, to review:
a. Training requirements indicated in the Contract Documents.
b. Work to be completed prior to commencing training.
c. Work progress and Progress Schedule relative to startup and training.
d. Scheduling constraints for City's and facility manager's personnel, relative to days and times of training sessions.
e. Preferred days for training.
f. Location where training will be performed and facilities available.
g. Required Submittals relative to training.
h. Other issues relative to training of operation and maintenance personnel.
2. Attendance is mandatory for the following:
a. Contractor's project manager.
b. Contractor's Site superintendent.
c. Project manager of Subcontractors responsible for furnishing materials and equipment for which training of operation and maintenance personnel is required.
d. Suppliers invited by Contractor.
e. Engineer.
f. City's (Owner's) Site Representative (OSR).
g. Facility manager's staff responsible for training coordination, and staff responsible for scheduling operation and maintenance personnel.
3. If additional information must be developed to adequately cover agenda items, reconvene conference as soon as possible.
4. Contractor shall prepare minutes summarizing the discussions of conference, decisions made, and agreements and disagreements, and distribute the minutes to each conference attendee and others as appropriate.

1.3 QUALITY ASSURANCE

A. Qualifications:
1. Supplier's Instructors:
a. Shall be factory-trained by manufacturer of material or equipment.
b. Supplier's instructors shall be proficient and experienced in performing training of the types required.
c. Instructors shall be proficient, clear, and easily understandable in spoken and written English language.
d. Qualifications of instructors are subject to acceptance by Engineer. If Engineer does not accept qualifications of proposed instructor, provide services of replacement instructor with acceptable qualifications.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Training Schedule: Detailed schedule of training sessions, demonstrating compliance with number of training sessions, hours required in the Contract Documents, and complying with the Contract Times. Submit training schedule Submittals in accordance with time frames specified in this Specifications section.

B. Informational Submittals: Submit the following:
1. Lesson Plan: Acceptable lesson plan for training on each material or equipment item, in accordance the Contract Documents. Lesson plan shall comply with requirements of this Specifications section as may be supplemented by Specifications sections where materials and equipment are specified. Include with lesson plan copy of handouts that will be used during training sessions. Submit lesson plan Submittals in accordance with time frames specified in this Specifications section.

2. Qualifications:
    a. Credentials of Supplier's proposed operation and maintenance instructor(s). Credentials shall demonstrate compliance with requirements of this Specifications section and shall include brief resume' and specific details of instructor's operating, maintenance, and training experience relative to the specific material and equipment for which instructor will provide training.
3. Minutes of training scheduling conference.

C. Closeout Submittals: Submit the following:
1. Trainee sign-in sheets for each training session. Submit to City's training coordinator with copy to Engineer.

1.5 LESSON PLAN

A. Supplier's lesson plan shall describe specific instruction topics, system components for which training will be provided, and training procedures. Handouts, if any, to be used in training shall be included with the lesson plan. Describe in lesson plan "hands-on" demonstrations planned for training sessions.

B. Submit acceptable lesson plan not less than 21 days prior to starting associated training.

C. Indicate in lesson plan estimated duration of each training segment.

D. Lesson plan shall include the following:
1. Material and Equipment Overview (required for all types of operation and maintenance training):
    a. Describe material and equipment's operating (process) function and performance objectives.
    b. Describe material and equipment's fundamental operating principles and dynamics.
    c. Identify equipment's mechanical, electrical, and electronic components and features. Group related components into subsystems and describe function of subsystem and subsystem's interaction with other subsystems.
    d. Identify all support materials and equipment associated with operation of subject equipment, such as air intake filters, valve actuators, motors, and other appurtenant items and equipment.
    e. Identify and describe safety precautions and potential hazards related to operation.
    f. Identify and describe in detail safety and control interlocks.
2. Operations Personnel Training:
    a. Material and Equipment Overview: As described in Paragraph 1.5.D.1 of this Specifications section.
    b. Operation:
        1) Describe operating principles and practices.
        2) Describe routine operating, startup, and shutdown procedures.
        3) Describe abnormal or emergency startup, operating, and shutdown procedures that may apply.
        4) Describe alarm conditions and responses to alarms.
        5) Describe routine monitoring and recordkeeping procedures.
        6) Describe recommended housekeeping procedures.
    c. Troubleshooting:
        1) Describe how to determine if corrective maintenance or an operating parameter adjustment is required.
3. Instrumentation/Controls and Electrical Maintenance Training:
    a. Materials and Equipment Overview: As described in Paragraph 1.5.D.1 of this Specifications section.
    b. Preventative Maintenance and Troubleshooting of Instrumentation and Control Systems. Engineer may grant waiver(s) to allow all training for a given system to be at the location of City's training facility.
    c. Preventative Maintenance and Troubleshooting of Other Electrical Systems: In accordance with requirements for Paragraph 1.5.D.3 of this Specifications section.

1.6 TRAINING AIDS

A. Supplier's instructor(s) shall incorporate training aids as appropriate to assist in the instruction. Provide handouts of text, tables, graphs, and illustrations as required. Other appropriate training aids include:
   1. Audio-visual aids, such as videos, Microsoft PowerPoint presentations, overhead transparencies, posters, drawings, diagrams, catalog sheets, or other items.
   2. Equipment cutaways and samples, such as spare parts and damaged equipment.
   3. Tools, such as repair tools, customized tools, and measuring and calibrating instruments.

B. Handouts:
   1. Supplier's instructor(s) shall distribute and use descriptive handouts during training. Customized handouts developed especially for training for the Project are encouraged.
   2. Photocopied handouts shall be good quality and completely legible.
   3. Handouts shall be coordinated with the instruction, with frequent references made to the handouts.
   4. Provide not less than 10 paper copies of each handout for each training session.

C. Audio-Visual Equipment: Training provider shall provide audio-visual equipment required for training sessions. If suitable equipment is available at the Site, City may make available facility's existing audio-visual equipment; however, do not count on facility's existing audio-visual equipment, if any, being available. Audio-visual equipment that training provider shall provide, as required, includes:
   1. Laptop computer, presentation software, and suitable projector.
   2. Power cords, power strips/surge protectors.
   3. As required, extension cords, HDMI cables and other video cabling, and spare bulb for projector.
   4. Laser pointer/slideshow remote controller with extra batteries.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 TRAINING DELIVERY

A. Training Delivery – General:
   1. Instructors shall be fully prepared for the training sessions. Training delivery shall be communicative, clear, and proceed according to lesson plan accepted by Engineer, with lesson content appropriate for trainees. If City or Engineer deems that training delivery does not comply with the Contract Documents, training shall be postponed, rescheduled, and re-performed in acceptable manner at no additional cost to City.
   2. Trainee Sign-in Sheets: In format acceptable to City, furnish sign-in sheet for trainees for each session. Sign-in sheets shall include the Project name; materials, equipment, or system for which training was provided; and type of training (e.g., operations, mechanical maintenance, instrumentation/controls and electrical maintenance, or other), and full name and operator license number (when applicable) of each trainee. Upon completion of training, submit copy of each sign-in sheet as indicated in Article 1.4 of this Specifications section.

B. "Hands-on" Demonstrations:
   1. Supplier's instructor(s) shall present "hands-on" demonstrations of operation and maintenance of materials and equipment for each training session, in accordance with lesson plan accepted by Engineer.
   2. Contractor and manufacturer shall furnish tools necessary for demonstrations.

3.2 SCHEDULE OF REQUIRED TRAINING

A. Supplier shall provide not less than the hours of training and number of sessions indicated in this Specifications Section. Travel time and expenses are responsibility of Supplier and are excluded from required training time indicated in the Contract Documents.

B. Shifts and Training Sessions Required:
   1. Operations at the Site take place 8 hours per day.
   2. Training Sessions per Shift:
      a. Operators: Maximum training per day is four hours; sessions longer than four hours shall be spread over multiple, preferably consecutive, days. Provide training sessions as follows:
         1) One training session during the day shift.
      b. Instrument/Controls and Electrical Maintenance: Provide one training session during day shift for indicated equipment. Maximum training per day is four hours; sessions longer than four hours will be spread over multiple, preferably consecutive, days.

END OF SECTION

SECTION 01 81 33
CYBER SECURITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. General requirements for cyber security measures applicable to all the Work.
   2. Requirements to furnish City copy of code and configuration files.
   3. Supplier and all other parties providing parts and services under this contract are subject to these conditions. This includes hardware and software, licensing, intellectual equipment, patent restrictions and use, copyright, and similar equipment, systems, and appurtenances covered under this Section.
   4. Requirements for vendors, suppliers and / or Contractor-furnished equipment with microprocessor-based equipment including:
      a. Providing full and unrestricted use by the City for equipment supplied under this contract including access, review, updates, and modification of software code, firmware and configurations of PLCs, PACs, RTUs, HMIs, DDCs, OITs, or any other microprocessor-based equipment.
      b. Allowing City to transfer to designated agents the right to perform this work on their behalf.
      c. Furnishing software source code for the system supplied.
      d. Coordinate with City to remove default usernames and passwords, to remove contractor passwords at time of system acceptance, and turn-over of all passwords utilized in the system.
   5. Requirements for vendors, suppliers and / or Contractor-furnished items for furnishing program code, passwords, keys, and configuration files upon project milestones and at substantial completion.

B. Scope:
   1. This Section indicates cyber security requirements applicable to all equipment, controls, devices, and other items furnished to City and City-furnished items modified as part of the Work, containing micro-processor based systems and that will be, can be (in the future), or may potentially be (in the future) connected to City's network or the internet.
   2. This Section applies regardless of whether the subject items were furnished or modified by Contractor, Subcontractor, or Supplier of any tier.
   3. By furnishing equipment, controls, devices, or other items for the Work, Suppliers and Subcontractors, if any, are bound by this Section's requirements to same extent Contractor is so bound.
   4. Supplier agrees to assist in cybersecurity basic hygiene practices as dictated by best practices included in this section, government regulation at time of bid, and as provided by the City's cyber security team. At a minimum, the supplier will coordinate with City and assign IP addresses and subnet masking, utilized of managed switches with unused ports disabled, provide all equipment with latest firmware at time of field installation.
   5. All equipment supplied will be current and not be obsolete or subject to a manufacturer's end-of-life notice of less than 2 years after startup.
      a. Provide any notices of manufacturer's end-of-life notices for all equipment at the time of submittal for approval of equipment. This shall include searching equipment websites during the submittal process to ensure the products are not nearing end of life.
   6. At Substantial Completion, the City shall be granted full use of equipment and services provided by equipment and its associated automation under this Section and shall include:

a. Full access and use of supplied software within any equipment supplied including PLCs, OIT, networking and communications equipment, gateways, and HMI code (including fully documented source code), internal function blocks or code shall be ceded to the City for their exclusive use at the location(s) of the equipment. These rights shall transfer to future locations or owners.
b. Right to modify, enhance or make changes to the equipment as deemed necessary or desired by the City, including hardware, software, networking settings, passwords or other information or settings that the City may change for maintenance, upgrade, or cybersecurity reasons.
c. Full release of claims to Intellectual Equipment, Trade Secrets, or Sensitive Information as supplied with this equipment as may be claimed by the supplier or any of their subcontractors, subconsultants and the like as regards equipment or services provided herein to the City.
d. No provisions for Non-Disclosure Agreements (NDAs) or other restrictions to restrict or prevent the City from obtaining or using information, licenses, electronic data, software are allowable.

7. The supplier shall furnish software source code for the equipment supplied. The code or any part of the system may not be hidden or protected by encryption, passwords, or other means without providing these passwords or access to the City's designated personnel.
8. The supplier shall take measures to limit the distribution of information on City's system information to the minimum personnel required. The supplier shall not publish to public facing media this information at any time.

C. Related Requirements:
1. Section 01 33 00 - Submittal Procedures.
2. Section 01 75 00 - Checkout and Startup Procedures.
3. Section 01 78 36 - Warranties.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:
1. Comprehensive asset inventory of all networked components:
a. Provide in Excel spreadsheet format.
b. Coordinate with the City or Engineer to determine the preferred method of delivery to assure security of information contained in asset inventory.
c. Include:
1) Device ID.
2) Manufacturer.
3) Model Number.
4) Serial Number.
5) MAC Address.
6) IP Address.
7) Device Use description.
8) Firmware Version.
2. Network Diagrams:
a. Provide in both AUTO CAD and PDF formats.
b. Coordinate with the City or Engineer to determine the preferred method of delivery to assure security of information contained in Network Diagrams.
c. Logical Network Diagram(s):
1) Depict information flow through network(s), and include:
a) Major network devices, subnets, and VLANs.
b) Include all wireless communication devices.
c) Include the following information for each networked device:
(1) Device ID.
(2) Device description.
(3) Manufacturer/model number.
(4) MAC address.

(5) IP address.
(6) Ports and Protocols

d. Physical Network Diagram(s):
1) Show all network components, ports, protocols, connections and cables.
a) Include all wireless communication devices.

B. Close-out Submittals: Submit the following:
1. Password Turn-over: Coordinate with City to securely transmit directly to City list of usernames and passwords applied to replace factory and Supplier's defaults.
2. Network-Capable Device Asset Inventory: Furnish, as unlocked, editable Microsoft Excel file listing all network-capable devices furnished or modified under this Section. List shall include:
a. Device name.
b. Device location (in network and physical location).
c. Manufacturer name.
d. Product name and model designation.
e. Manufacturer's serial number on device.
f. MAC address (when device is IP-addressable).
g. IP address (when device is IP-addressable).
h. Edition of revision number of installed firmware or operating system.
3. Backup of Application Software: Furnish directly to City Electronic Document copy of each software application and equipment configuration file necessary for City's Facility Manager to restore functionality of system after a system disaster or other such event.
a. Software source code for all PLCs, HMIs, OITs and other devices.
b. Configuration files, encryption information and other sensitive information for the full project scope.
4. Work will not be eligible for Substantial Completion until all closeout submittals, including required program code and configuration submittals, are received and accepted by Engineer.

C. Timing: Submittals will be required at the following project stages:
1. Network Diagrams and Asset Inventory – with control panel submittals.
2. Draft Software and Configuration Files, and As-Manufactured Network Diagrams – Available at Factory Acceptance Testing.
3. All documents available on-site upon equipment delivery to the project site.
4. All documents contained within Operation & Maintenance manuals.
5. Close-Out submittals at project closeout.

1.3 COPIES OF PROGRAM CODE AND CONFIGURATION FILES

A. Copies of Program Code and Configuration Files – General:
1. Submit as Electronic Documents only. Paper Submittals are not required for program code and configuration files.
2. Files to be securely transferred with limited distribution as requested by the City or supplier to protect sensitive information. Provide proof of file transfer for submittal record purposes.
3. In accordance with the Contract Documents, following Substantial Completion, City and facility manager shall have right to: (a) modify program code and configuration files, (b) update software and firmware, (c) revise system security settings, such as passwords, IP addresses, and other security settings, and (d) implement related modifications, without restriction or interference from Contractor, Subcontractor, Supplier, and others.
4. City and facility manager agree to use program code and configuration files only with City's facilities, as may be transferred to City's successors and assigns.
5. City and facility manager will not be subject to any Supplier-requested non-disclosure agreement that is not part of the Contract Documents.
6. Engineer agrees to not distribute program code and configuration files obtained under the Project, except in exchanging such files with City, facility manager, or their successors and assigns. Engineer will not be party to any Supplier-requested non-disclosure agreement.

B. Configuration Files:

1. Submit copies of system configuration prepared for the Project, such as setpoints for programmable controllers, facility SCADA display configurations, and similar configuration files.
2. Files to be securely transferred with limited distribution as requested by the City or supplier to protect sensitive information. Provide proof of file transfer for submittal record purposes.
3. Submit as separate files configuration files for each separate control and monitoring device for which configuration files are furnished. Clearly distinguish the device(s) associated with each file.
4. Contractor (including Subcontractors and Suppliers) is not responsible for configurations and control setpoints subsequently changed by City, facility manager, or others for whom either is responsible, not in accordance with Supplier's written recommendations and operation and maintenance instructions.

C. Program Code:
1. Submit copies of program code for programmable logic controllers (PLC), human-machine interfaces (HMI), operator interface terminals (OIT), and other programmable controllers, subject to the following:
    a. Submit for all PLCs, HMI, OITs, and other programmable controllers furnished as part of the Work, and where City's existing devices were modified as part of the Work, regardless of whether such program code is manufacturer's standard, or developed specifically for the Project, or a combination of manufacturer's standard program code and Project-specific program code. Contractor and associated Subcontractors and Suppliers are not responsible for program code modifications made by City or facility manager (or third parties retained by City or facility manager) that result in improper operation of materials, equipment, or systems or that invalidate applicable warranties and manufacturer's recommended operating instructions.
    b. Third-party, licensed, commercially available software (such as, but not limited to, Microsoft operating system software sold at retail, and commercial SCADA system software platforms, PLC programming software) is excluded from requirements of this Article. Furnish copies of commercially available, licensed, third-party software, where required, in accordance with the Contract Documents.
2. Submit annotated copies of complete PLC software programs:
    a. In native-format file including all applicable formats (ladder logic, function block diagram, sequential function chart, instruction list, structured text).
    b. In PDF-format file with fully annotated PLC code that can be read without the native configuration and programming environment on electronic media (DVD or USB drive).
3. Format Requirements:
    a. For ladder diagram logic, include complete cross-referencing of all logic elements. Annotate all elements with clearly understandable tags or descriptive labels.
    b. For function block diagram, label each function block with understandable tags or descriptive labels. Describe purpose and action of each function block.
    c. For sequential function chart, include extensive comments for each step to describe program step function.
    d. For instruction list and structured text, include extensive comments for each program line to describe program line function.
4. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.
5. Submit complete manufacturer's program code manuals.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 CONTRACTOR ACCESS TO INSTALLED EQUIPMENT

A. Unless specifically included within the plans and specifications, remote access appliances for interaction with programmable devices will not be accepted during construction or operation. Where remote access is required, vendor shall submit RFI for allowable methods and describe the specific remote access needs (i.e. programming, view only data, emergency support) and coordinate with City/Engineer on acceptable solution which achieves the owner's cybersecurity risk tolerance.

3.2 CONTRACTOR ACCESS TO CLIENT NETWORK WHILE ON-SITE

A. Contractor laptops utilized for programming and startup of programmable devices will not be allowed to connect to City's programmable device network.

3.3 CLOSEOUT ACTIVITIES:

A. Update firmware of programmable devices to Supplier's current version at time of Substantial Completion.

B. Usernames and Passwords:
   1. Change Supplier's default usernames and passwords in coordination with requirements of City's or facility manager's (as applicable) personnel, reference submittals section for password submission requirements.
   2. Remove each username and password established or used by Contractor, Subcontractor, or Supplier prior to Substantial Completion of equipment or system.

C. Programmable Operator Interface Terminals (OIT) and Other Graphical Interface Terminals:
   1. For equipment that supports multiple levels of security, configure the following security levels:
      a. View.
      b. Operate.
      c. Supervisor.
      d. Administrator.
   2. For equipment that supports only view/operate levels of security, provide password protection and furnish directly to City or facility manager (as applicable) passwords necessary to operate functions.
   3. Coordinate directly with City and facility manager passwords and furnish password turn-over Submittal required in this Section's "Submittals" Article.

END OF SECTION

DIVISION 03

CONCRETE

SECTION 03 15 19
ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for anchorages in concrete, including: cast-in-place anchor bolts, anchor rods, reinforcing anchorage adhesive, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.

1.2 REFERENCES

A. Definitions and Terminology:

1. This provision presents definitions and terminology, which have the meanings indicated in this provision, applied to the singular or plural thereof, and without regard to use of initial capital letters.
   a. Adhesive Anchors:
      1) Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
      2) Includes anchors using acrylics, epoxy and other similar adhesives.
   b. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.
   c. Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.
   d. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.
   e. Galvanizing: Hot-dip galvanizing in accordance with ASTM A123, ASTM A153 or ASTM F2329 with minimum coating of 2.0 ounces of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by reference standard.
   f. Hardware: As defined in ASTM A153.
   g. MPII: Manufacturer's printed installation instructions.
   h. Mechanical Anchors:
      1) Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.
      2) Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
      3) Drop-in anchors and other similar non-ICC ES approved anchors are unacceptable.
   i. Post-Installed Anchor: Adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

B. Reference Standards:

1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete and Commentary.
2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
   a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
3. American Institute of Steel Construction (AISC):
   a. 303, Code of Standard Practice for Steel Buildings and Bridges.
   b. 355.2, Seismic Testing of Post-Installed Concrete and Masonry Anchors in Cracked Concrete.
   c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.
4. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.

b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
i. F436, Standard Specification for Hardened Steel Washers.
j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
k. F594, Standard Specification for Stainless Steel Nuts.
l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
m. F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

5. International Code Council Evaluation Service (ICC-ES):
   a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.3 ADMINISTRATIVE REQUIREMENTS

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Code-required Special Instructions:
   a. Special Inspection is required in accordance with the building code for all concrete anchorages.
   b. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
   c. See the “Field Quality Control” Article in “Part 3 – Execution” of this Section for additional requirements.

B. Qualifications:

1. Installer:
   a. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.
   b. Installer for adhesive anchors installed in horizontal, upward incline, or overhead applications shall be certified by ACI-CRSI Adhesive Anchor Installation Certification Program.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Submit schedule (table or listing) of types, sizes (diameter, length, embedment length), material, finish, and proposed manufacturers of anchorages to concrete to be provided. Apportion by Project-specific application (for example, “Anchorages for cooling water pumps in basement”).
   b. Engineer’s approval of such Shop Drawing will be only for anchorages fully designed by Engineer.
2. Product Data:

a. Manufacturer published data and information for each anchor.
    1) Clearly indicate items that are proposed for the Work. Neatly strike out or obscure materials and products not proposed.
b. Manufacturer's published installation instructions and instructions for code-required special inspections and tests.
c. Post-Installed Anchors: In addition, submit for each post-installed anchor system current ICC-ES report, indicating the following:
    1) Manufacturer's certification that anchors comply with requirements indicated in the Contract Documents.
    2) Performance data indicating that anchor is approved by its manufacturer for use in cracked concrete.
    3) Seismic design categories for which anchor system is approved by ICC-ES report.
d. Anchorage layout drawings and details:
    1) Drawings showing location, configuration, spacing and edge distance.

3. Samples:
    a. Submit representative Samples of anchorages to concrete, when requested by Engineer. Engineer's approval of Samples will be for type and finish only.

B. Informational Submittals: Submit the following:

1. Supplier's Instructions:
    a. Submit manufacturer's published instructions for installation.
2. Field Quality Control Submittals:
    a. Submit written results of required field quality control activities indicated in this Section.
3. Qualifications Statements:
    a. Each installer.

PART 2 - PRODUCTS

2.1 MATERIALS – ALL ANCHORAGES

A. Materials – General:

1. This Article applies to all anchorages to concrete, regardless of whether fully designed by Engineer or delegated design professional. Requirements for delegated designs are in the following Article.
2. Additional requirements for anchorages fully designed by Engineer are indicated in the Article following requirements for delegated design anchorages.
3. For structural applications, do not use powder actuated fasteners and other types of bolts or fasteners not specified in this Section unless approved by Engineer or otherwise required by the Contract Documents.

B. Description:

1. Provide anchorages to concrete, of the types shown or indicated, to secure to concrete materials, equipment, and appurtenances installed as part of the Work.
2. Locations where anchorages are required are generally shown or indicated on the Drawings. Where not shown or indicated on the Drawings provide anchorages or the types required for materials, equipment, and systems where such materials, equipment, and systems are shown on the Drawings.
3. Anchorages required include those for materials, equipment, and systems shown on the structural Drawings and Drawing other than the structural Drawings.
4. Design loads for concrete anchorages are shown or indicated on the Drawings for anchorages where design responsibility is delegated to Contractor's delegated design professional. For such anchorages, embedment depths are not shown or indicated.

C. Post-Installed Mechanical and Adhesive Concrete Anchors:

1. Submerged application: ASTM F593, Type 316, minimum yield strength of 45,000 psi with matching nut and washer.
2. Non-submerged application: ASTM F593, Type 304 or Type 316, minimum yield strength of 45,000 psi with matching nut and washer.
3. Post-installed anchors and related materials shall be listed by ICC-ES or Engineer-approved equivalent.

D. Washers:

1. ASTM F436 unless indicated otherwise, finish to match bolt.
2. When stainless steel anchorage is provided for cast-in-place anchorages, provide washers of the same material and alloy as in the associated anchorage.
3. Plate washers: Minimum 1/2 inch thick fabricated ASTM A36 square plates as required.
4. Comply with manufacturer's written instructions for all post-installed anchorages.

E. Nuts:

1. ASTM A563 for cast-in-place anchorages.
2. When stainless steel anchorages are provided for cast-in-place anchorages, nuts shall comply with ASTM F594 and shall match material and alloy of the associated anchorage.
3. Follow manufacturer's requirements if using post-installed anchorage.

F. Galvanizing Repair Paint:

1. High zinc dust content paint for regalvanizing welds and abrasions.
2. ASTM A780.
3. Zinc content: Minimum 92 percent in dry film.
4. Products and Manufacturers: "ZRC Cold Galvanizing", by ZRC; or "High Performance Zinc Spray", by Clearco; or equal.

2.2 DELEGATED DESIGN ANCHORAGES TO CONCRETE

A. Manufacturers:

1. Post-installed anchor systems for indicated manufacturers are acceptable only when a current ICC-ES evaluation report is furnished as a Submittal and the subject anchorage system is approved by delegated design professional.
    a. Hilti.
    b. Dewalt.
    c. Simpson Strong-Tie.
    d. Or equal.

B. Description: Perform delegated design for anchorages when one or more of the following applies:

1. Design load for concrete anchorage is shown or indicated on the Drawings and anchorage embedment depth is not shown or indicated.
2. When specifically required by the Contract Documents.
3. When an anchorage is necessary but is not shown or indicated on the Drawings.
4. Anchorages shown on the Drawings other than the structural Drawings.

C. Performance and Design Criteria for Delegated Design Anchorages:

1. Determine design loads, including wind and seismic loads, in accordance with applicable building code and other Laws and Regulations.
2. For anchorage of equipment and non-structural components, use actual dead load and operating loads obtained by Contractor or delegated design professional from manufacturer. Design loads shall include operating conditions when equipment or element of the Work is in operation, dynamic loads, and other loads as appropriate or required by the building code or other Laws or Regulations.

3. Design assuming cracked concrete.

2.3 ANCHORAGES FULLY DESIGNED BY ENGINEER

A. When size, length, and details of anchorage are shown or indicated on the structural Drawings, such anchorages are considered as fully designed by Engineer and delegated design of such anchorage is not required.

B. Manufacturers:

1. For post-installed anchor systems regardless of whether proposed manufacturer is indicated below, furnish as Submittal current evaluation agency report and anchor system is certified by ICC-ES for cracked concrete conditions.
2. Mechanical Anchors:
    a. Hilti:
        1) Kwik Bolt TZ (ICC-ES ESR-1917).
    b. Dewalt:
        1) Power-Stud+ SD1 (ICC-ES ESR-2818).
    c. Simpson Strong-Tie:
        1) Strong-Bolt 2 (ICC-ES ESR-3037).
    d. Or equal.
3. Requests, if any, for Engineer's approval of "or-equals" or substitutes shall indicate proposed anchor has at least the same tension and shear strength as the associated anchorage products indicated by name in this Article.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, inspect and verify areas and conditions under which concrete anchorages will be installed.

1. Notify Engineer of conditions detrimental to proper and timely completion of the Work.
2. Do not proceed with the Work until unsatisfactory conditions are properly remedied.

3.2 INSTALLATION

A. Installation Requirements - General:

1. Install items in accordance with the Contract Documents, manufacturer's written instructions, and Laws and Regulations. Where such requirements conflict, obtain interpretation or clarification from Engineer prior to commencing the associated Work.
2. Perform the following unless shown or indicated otherwise:
    a. Provide stainless steel anchorages for connecting aluminum and steel members to concrete and masonry.
    b. Provide washers for all anchorages.
    c. Where exposed, extend threaded anchorage a minimum of 0.5 inch above top of fully-engaged nut. If anchorage is cut off to required maximum height, dress the threads to allow nuts to be removed without damage to nuts.
3. Tightening of nuts: Do the following after nuts are snug-tightened down:
    a. Upset anchorage threads to prevent nuts from backing off. Provide double nut or lock nut in lieu of upset threads for items that may require future removal.
    b. When two nuts are used per concrete anchor above the base plate, tighten top nut an additional 1/8 turn to "lock" the two nuts together.
    c. For post-installed anchorages, comply with MPII.

B. Mechanical Anchorages:

1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
2. Do not use where subjected to vibration.
3. May be used in overhead applications.
4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

C. Finishes:

1. Repair of damaged galvanized surfaces:
   a. Prepare damaged surfaces by abrasive blasting or power sanding.
   b. Repair damaged galvanized surfaces in accordance with ASTM A780.
   c. Apply galvanizing repair paint to not less than 6 mils dry film thickness in accordance with galvanizing repair material manufacturer's instructions and ASTM A780.

D. Ensure that embedded items are protected from damage and are not filled in with concrete or related materials.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

1. Tests and inspections of anchorages shall comply with ACI 355.2 and/or ACI 355.4 as applicable.
2. City reserves the right to inspect and test completed anchorages at a minimum of 10 to 25 percent of provided anchorages.

B. Defective Work:

1. Anchorages that do not successfully pass required field tests and inspections or that are otherwise deemed defective by Engineer shall be remedied, in accordance with the Contract Documents, at no cost to City.

3.4 CLEANING

A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.

END OF SECTION

DIVISION 10

SPECIALTIES

SECTION 10 14 00
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items.

B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. A13.1, Scheme for the Identification of Piping Systems.
   2. The International Society of Automation (ISA).
   3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. Z535.1, Safety Color Code.
      b. Z535.2, Environmental and Facility Safety Signs.
      c. Z535.3, Criteria for Safety Symbols.
      d. Z535.4, Product Safety Signs and Labels.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
      b. 704, Standard System for the Identification of Hazards of Materials for Emergency Response.
   5. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910.145, Specification for Accident Prevention Signs and Tags.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Catalog information for all identification systems.
      b. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. W.H. Brady Co.
   2. Panduit.
   3. Seton.
   4. National Band and Tag Co.
   5. Carlton Industries, Inc.

2.2 MANUFACTURED UNITS

A. Type A2 - Rectangle Metal Tags:
   1. Materials: Stainless steel.
   2. Size:

a. 3-1/2 inches x 1-1/2 inches minimum.
b. Thickness: 0.036 inches (20 GA) minimum.

3. Fabrication:
a. 3/16 inches minimum mounting hole.
b. Legend: Stamped and filled with black coloring.

4. Color: Natural.

B. Type C - Laminated Name Plates:
1. Materials: Phenolic or DR (high impact) acrylic.
2. Size:
a. Surface: As required by text.
b. Thickness: 1/16 inches.

3. Fabrication:
a. Outdoor rated and UV resistant when installed outdoors.
b. Two layers laminated.
c. Legend: Engraved through top lamination into bottom lamination.
d. Two drilled side holes, for screw mounting.

4. Color: Black top surface, white core, unless otherwise indicated.

C. Type D - Self-Adhesive Tape Tags and Signs:
1. Materials: Vinyl tape or vinyl cloth.
2. Size:
a. Surface: As required by text.
b. Thickness: 5 mils minimum.

3. Fabrication:
a. Indoor/Outdoor grade.
b. Weather and UV resistant inks.
c. Permanent adhesive.
d. Legend: Preprinted.
e. Wire markers to be self-laminating.

4. Color: White with black lettering or as specified.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

D. Type F - Underground Warning Tape:
1. Materials: Polyethylene.
2. Size:
a. 6 inches wide (minimum).
b. Thickness: 3.5 mils.

3. Fabrication:
a. Legend: Preprinted and permanently imbedded.
b. Message continuous printed.
c. Tensile strength: 1750 psi.

4. Color: As specified.

E. Underground Tracer Wire:
1. Materials:
a. Wire:
1) 10 GA AWG.
2) Type UF solid copper.

b. Wire nuts: Waterproof type.
c. Split bolts: Brass.

2.3 ACCESSORIES

A. Fasteners:
1. Bead chain: #6 brass, aluminum or stainless steel.
2. Plastic strap: Nylon, urethane or polypropylene.
3. Screws: Self-tapping, stainless steel.

4. Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install identification devices at specified locations.

B. All identification devices to be printed by mechanical process, hand printing is not acceptable.

C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.

D. Attach tags with 1/8 inches round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
   1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.

E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
   1. Several items of equipment mounted in housing to be individually tagged inside the compartment.

F. Tracer Wire:
   1. Continuous pass from each handhole and above grade at each structure.
   2. Coil enough wire at each handhole to extend wire a foot above the ground surface.
   3. 1,000 feet maximum spacing between valve handholes.
   4. If wire nuts are used for splicing, knot wire at each splice point leaving 6 inches of wire for splicing.
   5. Use continuous strand of wire between handholes and structures.

3.2 SCHEDULES

A. Instrumentation Systems:
   1. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
      a. Tag type: Type C - Phenolic Name Plates.
      b. Fastener: Screws.
      c. Legend:
         1) Letter height: 1/2 inches minimum.
         2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").
   2. Components inside equipment enclosure, (e.g., PLC’s, control relays, contactors, and timers):
      a. Tag type: Type D - Self-Adhesive Tape Tags.
      b. Fastener: Self.
      c. Legend:
         1) Letter height: 3/16 inches minimum.
         2) Description or function of component (e.g., "PLC-xxx” or “CR-xxx").
   3. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
      a. Tag type: Type C - Phenolic Name Plates.
      b. Fastener: Screws.
      c. Legend:
         1) Letter height: 1/4 inches minimum.
         2) Component ISA tag number as indicated on the Drawings (e.g., “HS-xxx”).

B. Electrical Systems:

1. Trenches with direct-buried conduit, or direct-buried wire and cable.
    a. Tag type: Type F - Underground Warning Tape.
    b. Letter height: 1-1/4 inches minimum.
    c. Location:
        1) 12 inches below grade.
    d. Communications (e.g., telephone, instrumentation, LAN, SCADA):
        1) Color: Orange with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”.
            b) Second line: “BURIED COMMUNICATION LINE BELOW”.
2. Fiber Optic Handholes
        1) Tag Type: Type A2 - Rectangle Metal Tags
        2) Letter height: 1 inch minimum.
        3) Location: Permanently affix to fiber optic hanholes using masonry screws or a heavy layer of outdoor epoxy adhesive.
        4) Legend: fiber optic handhole designation as indicated on the Drawings.
3. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/2 inches minimum.
        2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
4. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/4 inches minimum.
        2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., “HS-xxx”).
5. Microducts in handholes and pullboxes.
    a. Tag type: Type C – Phenolic Name Plates
    b. Fastener: Nylon strap.
    c. Tag microduct at both ends.
    d. Legend:
        1) Letter height: 1/4 inches minimum.
        2) Handhole or pullbox on opposite end of microduct.

END OF SECTION

DIVISION 26

ELECTRICAL

SECTION 26 05 00
ELECTRICAL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for electrical systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 01 61 03 - Equipment - Basic Requirements.
   2. Section 03 15 19 - Anchorage to Concrete.
   3. Section 10 14 00 - Identification Devices.
   4. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   5. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Institute of Steel Construction (AISC):
      a. Steel Construction Manual.
   2. American National Standards Institute (ANSI).
   3. ASTM International (ASTM):
      a. A36/A36M, Standard Specification for Carbon Structural Steel.
      b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C2, National Electrical Safety Code (NESC).
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   6. National Electrical Manufacturers Association (NEMA):
   7. Underwriters Laboratories, Inc. (UL).

B. Products to be listed by a Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable product standards.
   1. Applicable product standards including, but not limited to, ANSI, FM, IEEE, NEMA and UL.
   2. NRTL includes, but is not limited to, CSA Group Testing and Certification (CS), FM Approvals LLC (FM), Intertek Testing Services NA, Inc. (ETL), and Underwriters Laboratories, Inc. (UL).

1.3 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
   2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
   3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.

4. Highly corrosive and corrosive area: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
5. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 61 03 and individual specification sections for submittal requirements for products defined as equipment.
   2. General requirements:
      a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
      b. Include data sheets that include manufacturer's name and product model number.
         1) Clearly identify all optional accessories.
      c. Acknowledgement that products are NRTL listed or are constructed utilizing NRTL recognized components.
      d. Manufacturer's delivery, storage, handling and installation instructions.
      e. Product installation details.
      f. See individual specification sections for any additional requirements.
   3. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.

B. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
   1. Outdoor areas:
      a. Wet.
      b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
   2. Indoor areas:
      a. Dry.
      b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:
   1. Manufacturers:
      a. Modular strut:

1) Unistrut Building Systems.
2) B-Line by Eaton.
3) Globe Strut.
4) Superstrut by Thomas & Betts.

2. Material requirements:
   a. Modular strut:
      1) Galvanized steel (hot-dipped): ASTM A123/123M or ASTM A153/A153M.
      2) Stainless steel: AISI Type 316.
      3) PVC coated galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.
   b. Structural members (e.g., I beams, L and C channels):
      1) Galvanized steel (hot-dipped): ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
   c. Mounting plates:
      1) Galvanized steel (hot-dipped): ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
   d. Mounting hardware:
      1) Galvanized steel.
      2) Stainless steel.
   e. Anchorage per Specification Section 03 15 19.

B. Field touch-up of galvanized surfaces.
   1. Zinc-rich primer.
      a. Two heavy coats, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including pre-purchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:
   1. NFPA 70.
   2. IEEE C2.
   3. The manufacturer's instructions.

C. Conduit routings and stub up locations that are shown on the Drawings are approximate; exact routing to be as required for equipment furnished and field conditions.
   1. The Contractor is responsisble for routing all conduits.

D. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.

E. Install equipment plumb, square and true with construction features and securely fastened.

F. Install electrical equipment, including pull and junction boxes, minimum of 6 inches from process, gas, air and water piping and equipment.

G. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.

H. Device Mounting Schedule:
   1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
      a. Electrical Pullboxes (outdoor) - as indicated on the Drawings.

I. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.

1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 inches in equipment location with the Engineer's approval.

J. Provide electrical equipment support system per the following area designations:
   1. Dry areas:
      a. Galvanized system consisting of hot-dipped galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
   2. Wet areas:
      a. Galvanized system consisting of hot-dipped galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
   3. Corrosive areas:
      a. Stainless steel system consisting of stainless steel channels and fittings, nuts and hardware.
      b. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.
   4. Highly corrosive areas:
      a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.

K. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
   1. See Specification Section 03 15 19.
   2. Do not cut, or weld to, building structural members.
   3. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

L. Provide non-metallic corrosion resistant spacers to maintain minimum 1/4 inches separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.

M. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.

N. Screen or seal all openings into equipment mounted outdoors, including handholes, to prevent the entrance of rodents and insects.

O. Do not use materials that may cause the walls or roof of a building to discolor or rust.

P. Identify electrical equipment and components in accordance with Specification Section 10 14 00.

3.2 FIELD QUALITY CONTROL

A. Replace equipment and systems found inoperative or defective and re-test.

B. Cleaning:
   1. See Specification Section 01 74 00.

C. The protective coating integrity of support structures and equipment enclosures shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.

4. Repair surfaces which will be inaccessible after installation prior to installation.
5. See Specification Section 26 05 33 for requirements for conduits and associated accessories.

D. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01 75 00.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLE - 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Fiber optic cable.
      b. Underground tracer wire.
      c. Wire connectors.
      d. Insulating tape.
      e. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
      a. 568, Commercial Building Telecommunications Cabling Standard.
   2. Underwriters Laboratories, Inc. (UL):
      a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
      b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
      c. 467, Standard for Safety Grounding and Bonding Equipment.
      d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
      e. 486C, Standard for Safety Splicing Wire Connections.
      f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
      g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
      h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
      i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.
   2. Test reports:
      a. Fiber optic cable test reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Wire connectors:
      a. Burndy Corporation.
      b. Buchanan.
      c. Ideal.
      d. Ilsco.
      e. 3M Co.
      f. Teledyne Penn Union.
      g. Thomas and Betts.
      h. Phoenix Contact.
   2. Insulating and color coding tape:
      a. 3M Co.
      b. Plymouth Bishop Tapes.
      c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

A. Fiber Optic Cable:
   1. See Section 27 10 00 for Fiber Optic cable requirements.

B. Underground Tracer Wire:
   1. Solid copper, #10AWG.
   2. Type UF insulation.

C. Wire Connectors:
   1. Twist/screw on type:
      a. Insulated pressure or spring type solderless connector.
      b. 600 V rated.
      c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
      d. Phase and neutral conductors: Conform to UL 486C.
   2. Compression and mechanical screw type:
      a. 600 V rated.
      b. Ground conductors: Conform to UL 467.
      c. Phase and neutral conductors: Conform to UL 486A.

D. Insulating and Color Coding Tape:
   1. Pressure sensitive vinyl.
   2. Premium grade.
   3. Heat, cold, moisture, and sunlight resistant.
   4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
   5. For cold weather or outdoor location, tape must also be all-weather.
   6. Color:
      a. Insulating tape: Black.
      b. Color coding tape: Fade-resistant color as specified herein.
   7. Comply with UL 510.
   8. TBT-20 for use in tracer wire splices.

E. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
   1. Underground Tracer Wire:
      a. Dry-compression type.
      b. Wrap with TBT-20 rubber tape to provide a watertight seal.
      c. All splices shall be made in fiber optic handholes.
   2. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

B. Insulating Tape Usage:
   1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
   2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
   3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

C. Fiber Optic Cable:
   1. Install all fiber optic cable in conduit or microduct.
   2. Splicing:
      a. Optical fibers shall not be spliced.
   3. Install cables in accordance with the requirements of NFPA 70.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing:
   1. Cable - Optical Fiber:
      a. Perform inspections on tests per TIA/EIA/ANSI 455-78-B, including:
         1) Optical time domain reflectometer test.
         2) Power attenuation test.
         3) Gain margin test.
         4) See additional requirements in Section 27 10 00.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for grounding and bonding system(s).

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 10 14 00 - Identification Devices.
   2. Section 26 05 00 - Electrical - Basic Requirements.
   3. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   4. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   4. Underwriters Laboratories, Inc. (UL):
      a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and grounding clamps, connectors and terminals:
      a. ERICO by Pentair.
      b. Harger Lightning & Grounding.
      c. Heary Bros. Lightning Protection Co. Inc.
      d. Burndy by Hubbell.
      e. Robbins Lightning, Inc.
      f. Blackburn by Thomas & Betts.
      g. Thompson Lightning Protection, Inc.

2.2 COMPONENTS

A. Wire and Cable:
   1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
   2. Insulated conductors: Color coded green, per Specification Section 26 05 19.

B. Conduit: As specified in Specification Section 26 05 33.

C. Ground Rods:
   1. 5/8 inches x 10 feet.
   2. Copper-clad:
      a. 10 mil minimum uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
      b. Corrosion resistant bond between the copper and steel.
      c. Hard drawn for a scar-resistant surface.

D. Grounding Clamps, Connectors and Terminals:
   1. Mechanical type:
      a. Standards: UL 467.
      b. High copper alloy content.
   2. Compression type for interior locations:
      a. Standards: UL 467.
      b. High copper alloy content.
      c. Non-reversible.
      d. Terminals for connection to bus bars shall have two bolt holes.
   3. Compression type suitable for direct burial in earth or concrete or in fiber optic handholes:
      a. Standards: UL 467, IEEE 837.
      b. High copper alloy content.
      c. Non-reversible.
      d. Factory filled with oxide inhibiting compound.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
   3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections. After connection, apply manufacturers approved touch-up paint to protect metallic surface from corrosion.
   4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves and install sleeve per Specification Section 01 73 20.
      a. Seal the sleeve interior to stop water penetration.
   5. Do not splice grounding electrode conductors except at ground rods.
   6. Install ground rods and grounding electrode conductors in undisturbed, firm soil.
      a. Provide excavation required for installation of ground rods and conductors.
      b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
      c. Unless otherwise specified, connect conductors to ground rods with compression type connectors or exothermic weld.
      d. Provide sufficient slack in conductor to prevent conductor breakage during backfill or due to ground movement.
      e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.

B. Grounding Electrode System:
   1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
      a. All grounding electrode conductors terminate on a main ground bar located adjacent to the service entrance equipment.
   2. Single ground rod grounding system:
      a. Single ground rod system consists of a single ground rod.

b. Place ground rod a minimum of 5 feet from the structure foundation with the top of the ground rod 4 inches above grade or the bottom of the fiber optic handhole.
c. Grounding conductor: Bare conductor, sized as indicated on the Drawings.

C. Supplemental Grounding Electrode:
1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.
a. See Grounding Electrode System paragraph for conductor termination requirements.
2. Equipment support rack and pedestals mounted outdoors, including pullboxes and fiber patch panels mounted on the support racks:
a. Connect metallic structure to a ground rod.
b. Grounding conductor: #6 AWG minimum.

D. Raceway Bonding/Grounding:
1. Install all metallic raceway so that it is electrically continuous.
2. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

E. Fiber Optic Handhole Grounding:
1. Provide a ground rod handhole for bonding/grounding internal metal parts and microduct tracer wires.
a. Expose a minimum of 4 inches of the rod above the floor for field connections to the rod.
2. Connect all exposed metal parts (e.g., conduits and cable racks) to the ground rod.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system uncovered until observed by City.

B. Acceptance testing:
1. Grounding:
a. Perform inspections and tests per NETA ATS 7.13.
b. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 26 05 00 - Electrical - Basic Requirements.
   2. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   3. Section 26 05 43 - Electrical - Exterior Underground.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI).
   2. ASTM International (ASTM):
      a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
      c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
      d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
      e. TC 14.AG, Aboveground Reinforced Thermosetting Resin Conduit and Fittings.
      f. TC 14.BG, Belowground Reinforced Thermosetting Resin Conduit and Fittings.
   4. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C80.1, Electric Rigid Steel Conduit (ERSC).
      b. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   6. Underwriters Laboratories, Inc. (UL):
      a. 1, Standard for Flexible Metal Conduit.
      b. 6, Electrical Rigid Metal Conduit - Steel.
      c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      d. 360, Standard for Liquid-Tight Flexible Metal Conduit.
      e. 467, Grounding and Bonding Equipment.
      f. 514B, Conduit, Tubing, and Cable Fittings.
      g. 651, Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
      h. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
    a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    b. See Specification Section 26 05 00 for additional requirements.
2. Fabrication and/or layout drawings:
    a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Rigid metal conduits and electrical metallic tubing:
    a. Allied Tube and Conduit.
    b. Western Tube and Conduit Corporation.
    c. Wheatland Tube.
2. PVC coated rigid metal conduits:
    a. Ocal by Thomas & Betts.
    b. Robroy Industries.
3. Rigid nonmetallic conduit:
    a. Prime Conduit.
    b. Cantex, Inc.
    c. Osburn Associates, Inc.
4. Fiber Optic Microduct
    a. Dura-Line “FutrePath”.
    b. Approved Equal.
5. Conduit fittings and accessories:
    a. Appleton by Emerson Electric Co.
    b. Carlon by Thomas & Betts.
    c. Cantex, Inc.
    d. Crouse-Hinds by Eaton.
    e. Killark by Hubbell.
    f. Osburn Associates, Inc.
    g. O-Z/Gedney by Emerson Electric Co.
    h. Raco by Hubbell.
    i. Steel City by Thomas & Betts.
    j. Thomas & Betts.
6. Support systems:
    a. Unistrut by Atkore International, Inc.
    b. B-Line by Eaton.
    c. Kindorf by Thomas & Betts.
    d. Minerallac Company.
    e. CADDY by Pentair.
    f. Superstrut by Thomas & Betts.
7. Outlet, pull and junction boxes:
    a. Appleton by Emerson Electric Co.
    b. Crouse-Hinds by Eaton
    c. Killark by Hubbell.
    d. O-Z/Gedney by Emerson Electric Co.
    e. Steel City by Thomas & Betts.
    f. Raco by Hubbell
    g. Bell by Hubbell.

h. Hoffman Engineering.
i. Wiegmann by Hubbell.
j. B-Line by Eaton.
k. Adalet.
l. RITTAL North America LLC.
m. Stahlin by Robroy Enclosures.

2.2 RIGID METAL CONDUITS

A. Rigid Galvanized Steel Conduit (RGS):
1. Mild steel with continuous welded seam.
2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
3. Threads galvanized after cutting.
4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
5. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6.

B. PVC-Coated Rigid Steel Conduit (PVC-RGS):
1. Nominal 40 mil Polyvinyl Chloride Exterior Coating:
a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
2. Nominal 2 mil, minimum, urethane interior coating.
3. Urethane coating on threads.
4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.
5. Female Ends:
a. Have a plastic sleeve extending a minimum of one pipe diameter or 2 inches, whichever is less beyond the opening.
b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
6. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6, NEMA RN 1.

2.3 RIGID NONMETALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
2. Rated for direct sunlight exposure.
3. Fire retardant and low smoke emission.
4. Shall be suitable for use with 90 degrees C wire and shall be marked "maximum 90 degrees C".
5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.

2.4 FIBER OPTIC MICRODUCT

A. Outside Plant Backbone Fiber Optic Microduct
1. Microduct:
a. Color: Orange outer sheath. Unique color for each microduct in the microduct assembly.
b. Suitable for direct-burial appliations.
c. Manufacturer markings every foot.
d. Microducts:
1) Microduct size: 16mm OD / 12mm ID (“16/12”).
2) Quantity of microducts (“ways”) in the microduct assembly: 4
3) Microduct colors: Blue, Orange, Green, Brown
e. Material:
1) Microduct material: HDPE.
2) Microduct lining: “SuperSilicore” or similar low friction pulling lining.
3) Microduct assembly oversheath: HDPE, “thicker oversheath”.

f. Tracer / Locate wire: 20AWG minimum, insulated copper wire internal to the microduct assembly.

2. Accessories and Tools:
   a. All microduct accessories and installation tools shall be approved by the microduct manufacturer for use with the microduct product.
   b. Accessories include, but are not limited to:
      1) Enclosure connectors and bulkhead fittings.
      2) Airtight microduct couplers.
      3) End caps and end plugs.
      4) Gas block connetors.
      5) Sealing kits, to seal the annular areas between the microducts and the oversheath.
      6) Microduct cutting and stripping tools.
      7) Cable installation lubricants.
      8) Test equipment, apparatus, tools, materials, and accessories.

2.5 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS
   1. Locknuts:
      a. Threaded steel or malleable iron.
      b. Gasketed or non-gasketed.
      c. Grounding or non-grounding type.
   2. Bushings:
      a. Threaded, insulated metallic.
      b. Grounding or non-grounding type.
   3. Hubs: Myers hubs, threaded, insulated and gasketed metallic for raintight connection.
   4. Couplings:
      a. Threaded straight type: Same material and finish as the conduit with which they are used on.
      b. Threadless type: Gland compression or self-threading type, concrete tight.
   5. Unions: Threaded galvanized steel or zinc plated malleable iron.
   6. Conduit bodies (ells and tees):
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Standard and mogul size.
      c. Cover:
         1) Clip-on type with stainless steel screws.
         2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
   7. Conduit bodies (round):
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
   8. Standards: UL 467, UL 514B, UL 1203.

B. Fittings for Use with PVC-RGS:
   1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RGS" and coated as defined under paragraph "PVC Coated Rigid Steel Conduit (PVC-RGS)."

C. Fittings for Use with Rigid Nonmetallic PVC Conduit:
   1. Coupling, adapters and conduit bodies:
      a. Same material, thickness, and construction as the conduits with which they are used.
      b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
      c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
   2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
   3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

D. Weather and Corrosion Protection Tape:
   1. PVC based tape, 10 mils thick.
   2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
   3. Used with appropriate pipe primer.

2.6 ALL RACEWAY AND FITTINGS

A. Mark Products:
   1. Identify the nominal trade size on the product.
   2. Stamp with the name or trademark of the manufacturer.

2.7 PULL AND JUNCTION BOXES

A. NEMA 4X Rated (metallic):
   1. Body and cover: 14 GA Type 304 or 316 stainless steel.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Hinged door and stainless steel screws and clamps.
   6. Door with oil-resistant gasket.

B. NEMA 12 Rated:
   1. Body and cover:
      a. 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
      b. Type 5052 H-32 aluminum, unpainted.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
   6. Flat door with oil resistant gasket.

C. Miscellaneous Accessories:
   1. Rigid handles for covers larger than 9 square feet or heavier than 25 pounds.
   2. Split covers when heavier than 25 pounds.
   3. Weldnuts for mounting optional panels and terminal kits.
   4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

D. Standards: NEMA 250, UL 50.

2.8 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
   1. Material requirements.
      a. Galvanized steel (hot-dipped): ASTM A123/A123M or ASTM A153/A153M.
      b. Stainless steel: AISI Type 316.
      c. PVC coat galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.

B. Single Conduit and Outlet Box Support Fasteners:
   1. Material requirements:
      a. Zinc plated steel.
      b. Stainless steel.
      c. PVC coat malleable iron or steel: 20 mil PVC coating.

2.9 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

A. Sleeves, smoke and fire stop fitting through walls and floors:
   1. See Specification Section 01 73 20.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
   1. NFPA 70.
   2. Manufacturer instructions.

B. Size of Raceways:
   1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
   2. Unless specifically indicated otherwise, the minimum raceway size shall be:
      a. Conduit: 1 inche.

C. Field Bending and Cutting of Conduits:
   1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
   2. Do not reduce the internal diameter of the conduit when making conduit bends.
   3. Prepare tools and equipment to prevent damage to the PVC coating.
   4. Degrease threads after threading and apply a zinc rich paint.
   5. Debur interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
      a. Total nominal thickness: 40 mil.
   4. Repair surfaces which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.
   1. Pull mandrel with diameter nominally 1/4 inches smaller than the interior of the conduit, to remove obstructions.
   2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
   3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.
   1. See Specification Section 01 73 20.

3.2 RACEWAY INSTALLATION – FIBER OPTIC MICRODUCT

A. Refer to Section 26 05 43 for installation and testing requirements for fiber optic microduct.

3.3 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.
   1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.

2. Run in straight lines parallel to or at right angles to building lines.
3. Do not route conduits:
    a. Through areas of high ambient temperature or radiant heat.
4. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly impair the strength of the construction. Do not place conduit penetrations in columns.
5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All conduits within a structure shall be installed exposed.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 feet:
1. Between telecommunication and 600 V and less AC power or control: 6 inches.
2. Between process, gas, air and water pipes: 6 inches.

D. Conduits shall be installed to eliminate moisture pockets.
1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.
1. See Specification Section 01 73 20.
2. Existing construction:
    a. Core drill openings in masonry and concrete.
    b. Avoid structural members and rebar.
    c. Seal with backer rod and sealant. Seal both sides of penetration where accessible.

3.4 RACEWAY APPLICATIONS

A. Raceway shall be RGS, PVC-RGS, or PVC-80 as indicated on the Drawings, generally:
1. RGS in interior locations in buildings.
2. PVC-RGS for exterior locations.
3. PVC-80 for elbows and risers at microduct turn-ups to fiber pullboxes.

B. Underground Conduit, including fiber optic microduct: See Specification Section 26 05 43.

3.5 CONDUIT FITTINGS AND ACCESSORIES

A. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

B. Threaded connections shall be made wrench-tight.

C. Conduit joints shall be watertight:
1. Outdoors.

D. Terminate Conduits:
1. In NEMA 12 rated enclosures:
    a. Watertight, insulated and gasketed hub and locknut.
2. In NEMA 4X rated enclosures:
    a. Watertight, insulated and gasketed hub and locknut.

3.6 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
   1. All areas:
      a. Galvanized system consisting of: Hot-dipped galvanized steel channels and fittings, nuts and hardware and conduit clamps.

B. Permitted single conduit support fasteners per area designations and conduit types:
   1. All areas:
      a. Galvanized system consisting of: Hot-dipped galvanized steel channels and fittings, nuts and hardware and conduit clamps.

C. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.
   4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 pounds.
      a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
      b. Conduit hangers:
         1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
      c. Do not use suspended ceiling support systems to support raceways.
      d. Hangers in metal roof decks:
         1) Utilize fender washers.
         2) Not extend above top of ribs.
         3) Not interfere with vapor barrier, insulation, or roofing.
   5. Conduit support system fasteners:
      a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
      b. Do not use concrete nails and powder-driven fasteners.

3.7 PULL AND JUNCTION BOX INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. See Specification Section 26 05 00 and the Drawings for area classifications.
   3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
   4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Pull and Junction Boxes:
   1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
      a. Make covers of boxes accessible.
   2. Permitted uses of NEMA 4X metallic enclosure:
      a. Outdoors.
   3. Permitted uses of NEMA 12 enclosure:
      a. Indoors.

END OF SECTION

SECTION 26 05 43
ELECTRICAL - EXTERIOR UNDERGROUND

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Handholes.
      b. Underground conduits.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 10 14 00 - Identification Devices.
   2. Section 26 05 26 - Grounding.
   3. Section 26 05 33 - Raceways and Boxes.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Provide signed and sealed design computations for handholes indicating compliance with design load rating.
   2. Fabrication and/or layout drawings:
      a. Provide dimensional drawings of each handhole indicating all specified accessories and conduit entry locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Precast handholes:
      a. Lister Industries Ltd.
      b. Oldcastle Enclosure Solutions.
      c. Jensen Precast and Utility Concrete Products.
   2. Handhole accessories:
      a. Cantex, Inc.
      b. Condux International, Inc.
      c. Neenah Enterprises, Inc.
      d. Prime Conduit.
      e. Thomas and Betts.
      f. Underground Devices, Inc.
      g. Unistrut by Atkore International, Inc.

2.2 HANDHOLES

A. Precast Handholes:
   1. Fiberglass reinforced polymer concrete:
   2. AASHTO live load rating: H-20 for full deliberate vehicle traffic.
   3. Mating edges: Tongue and groove type.
   4. Solid bottom.
   5. Cast the legend "COMMUNICATIONS" into handhole covers.
   6. Gasketed removable top slab with lifting eyes and cast in frame for cover.

2.3 UNDERGROUND CONDUIT AND ACCESSORIES

A. Fiber Optic Microduct: See Specification Section 26 05 33 for microduct material requirements. Fiber optic microduct installation requirements are in this Section.

PART 3 - EXECUTION

3.1 GENERAL

A. Drawings indicate the intended location of handholes and routing of fiber optic microduct.
   1. Field conditions may affect actual routing.

B. Handhole Locations:
   1. Approximately where shown on the Drawings.
   2. As required for pulling distances.
   3. As required to keep pulling tensions under allowable cable tensions.
   4. As required for number of bends in ductbank routing.
   5. Shall not be installed in a swale or ditch.
   6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
   7. Locations are to be approved by the Engineer or City prior to excavation and placement or construction of manholes and handholes.

C. Install products in accordance with manufacturer's instructions.

D. Install manholes and handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.

3.2 HANDHOLES

A. Prefabricated Composite Material Handholes:
   1. For use in areas subjected to occasional non-deliberate vehicular traffic.
   2. Place handhole on a foundation of compacted 1/4 to 1/2 inches crushed rock or gravel a minimum of 8 inches thick and 6 inches larger than handholes footprint on all sides.
   3. Provide concrete encasement ring around handhole per manufacturers installation instructions (minimum of 10 inches wide x 12 inches deep).
   4. Install so that the surrounding grade is 2 inches lower than the top of the handhole.
   5. Size: As indicated on the Drawings.
   6. In each handhole, drive 5/8 inches x 10 feet long copper clad ground rod into the earth with approximately 4 inches exposed above finished floor.
      a. Drill opening in floor for ground rod.
      b. Connect all metallic components to ground rod by means of #8 AWG minimum copper wire and approved grounding clamps.
      c. Utilize additional clamps in the handhole if the quantity of ground wires exceeds three.
   7. Label each handhole with a stainless steel tag indicating the handhole designation per the Drawings. Tags are described in Section 10 14 00.

3.3 UNDERGROUND CONDUITS

A. General Installation Requirements:
   1. Ductbank types per location:
      a. Direct-buried conduit(s):
         1) All fiber optic microduct runs.
   2. Do not place concrete or soil until microducts have been observed by the Engineer.
   3. During construction and after conduit installation is complete, plug the ends of all microducts.
   4. Place warning tape in trench directly over fiber optic microduct in accordance with Specification Section 10 14 00 when microduct is intalled with any open-trenching method.

5. Placement of conduits stubbing into handholes shall be located to allow for proper bending radiuses of the cables.

B. Fiber Optic Microducts:
   1. Install so that the top of the uppermost conduit, at any point:
      a. Is not less than 30 inches below grade.
   2. Install direct-buried, using directional-drilling, microtrenching, or open-cut trenching.
   3. Maintain minimum bend radius of microduct per manufacturer's instructions at all times.
   4. Splices or joints of microducts between hand holes are prohibited. Microduct shall be a continuous and unbroken segment between sequential handholes, and between handholes and pullbox locations.
   5. Microducts shall enter handholes horizontally through the narrow ends of the handholes. Do not turn-up microducts from the bottom of the handholes, nor enter through the wide sides of the hanholes.
   6. Install a supplementary #10AWG solid copper tracer wire with all microducts.
   7. Tag each microduct assembly in each handhole and at each above-ground pullbox with a engraved phenolic tag attached with nylon wiretie. Each tag shall indicate the location of the opposite end of the microduct assembly (handhole or above-ground pullbox.) Tags are described in Section 10 14 00.
   8. Test all microducts following installation and before fiber optic cable is installed, including testing of spare microducts that will not have fiber optic cable installed in the original construction.
      a. Pressure test with compressed air to verify airtight/watertight seals.
      b. Blow a ball chain or test probe through the microducts to verify that the individual ducts are intact and not pinched, kinked, out-of-round, or otherwise compromised or unusable.
         1) Use a "catcher" device to receive the test device blown through the microducts.

END OF SECTION

DIVISION 27

COMMUNICATIONS

SECTION 27 10 00
STRUCTURED CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for the structured cabling system such as:
      a. Service entrance protection.
      b. Cabinets, racks, frames and enclosures.
      c. Termination blocks and patch panels.
      d. Cable management and cable pathways.
      e. Backbone cabling.
      f. Patch cords.

B. Related Sections include but are not necessarily limited to:
   1. Section 26 05 00 - Electrical - Basic Requirements.
   2. Section 26 05 26 - Grounding and Bonding.
   3. Section 26 05 33 - Raceways and Boxes.
   4. Section 26 05 43 – Electrical-Exterior Underground

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Building Industry Consulting Service International (BICSI).
   2. Electronics Components Industry Association (ECA):
      a. 310, Cabinets, Racks, Panels and Associated Equipment.
   3. National Electrical Manufacturers Association (NEMA):
      a. WC 66, Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With Or Without An Overall Shield) For Use In LAN Communication Wiring Systems.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
      a. 526-7, Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant.
      b. 568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
      c. 568-C.3, Optical Fiber Cabling Components Standard.
      d. 598-D, Optical Fiber Cable Color Coding.
      e. 606-B, Administration Standard for Telecommunications Infrastructure.
      f. 607-B, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

B. Qualifications:
   1. Telecommunications Contractor:
      a. Shall be regularly and professionally engaged in the business of the applications, installation, and testing of telecommunications systems and equipment.
      b. Include three references of similar scope jobs completed in the last two years.
      c. Supervisors and installers shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level.
      d. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have:
         1) A minimum of five years experience in the installation of the fiber optic cable and components.

2) Factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

2. Manufacturer:
   a. Company specializing in manufacturing products specified in this Section with minimum 10 years documented experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.3 SYSTEM DESCRIPTION

A. The building telecommunications cabling and pathway system shall include:
   1. All permanently installed backbone and horizontal cabling.
   2. Horizontal and backbone pathways.
   3. Service entrance facilities.
   4. Work area pathways.
   5. Racks.
   6. Cabinets.
   7. Enclosures.
   8. Conduit.
   9. Raceway.
   10. Patch panels.
   11. Fiber enclosures and hardware for splicing.

B. All components required for the above shall be provided for a fully tested operational system per the latest TIA/EIA/ANSI Standards.

C. Provide and install all components per this Specification for the Structured Cabling System.

D. Active equipment including switched hubs, routers, data switch(es) for fiber/copper shall be provided by others under a separate contract.

E. Patch cords connected to active equipment shall be installed by others.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Provide product technical data including:
      a. Submittal data for all products specified in PART 2 of this Specification.
      b. See Specification Section 26 05 00 for additional requirements.
   2. Fabrication and/or layout drawings, sealed and approved by a registered communications distribution designer (RCDD):
      a. Layout of full-site fiber optic network.
         1) Include all existing buildings and site features, buildings and site features to be constructed in the Persigo WWTP Expansion project, and fiber handoles.
      b. Layout of complete building per floor:
         1) Building area boundaries, backbone systems and horizontal pathways.
      c. Building area drawings:
         1) Drop locations and cable identifications in accordance with TIA-606.
      d. Typical detail drawings:
         1) Faceplate labeling, faceplate types, and firestopping.
   3. Certificates:
      a. Telecommunications Contractor and Installers qualifications.
      b. Key Personnel qualifications.
      c. Manufacturer qualifications.
   4. Test reports:
      a. Testing plan and procedures.
      b. Telecommunications cabling test results.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation.
   1. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.
   2. Components shall be UL or third-party certified.

2.2 PATCH PANELS

A. Patch panels mounted in equipment racks with sufficient ports to accommodate all installed cable:
   1. Fiber Optic Patch Panel:
      a. Panel shall accommodate 24 duplex connectors (1U maximum).
      b. Panel shall have cable management tray, incoming cable strain relief and cable management guides.
      c. Connectors shall be duplex LC.
      d. Connectors shall be unkeyed.
      e. Provide dust covers for unused connectors.

2.3 BACKBONE CABLING SYSTEM

A. Backbone Fiber Cable:
   1. Singlemode, 9um/125um OS2 rated cable, formed into 24-strand color coded groups.
   2. Maximum attenuation:
      a. At 1310 nm: 0.4 dB/km.
      b. At 1550 nm: 0.3 dB/km.
   3. Maximum tensile load:
      a. Installation: 300 pounds.
      b. Operation: 90 pounds.
   4. Cable shall be label-verified.
   5. Cable jacket shall polyethylene.
   6. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
   7. Cable shall be designed and shall be suitable for installation in the underground microduct system, and shall include an internal stiffening member to aid in cable installation in the microduct.
   8. Cable shall be AFL “OSP MicroCore”, part number “LM249C6101NS”.

2.4 HORIZONTAL CABLING SYSTEM

A. Horizontal Fiber Cable:
   1. Singlemode, 9um/125um OS2 rated cable.
   2. Cable shall be label-verified.
   3. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
   4. Cable shall be rated CMP per NFPA 70.

2.5 PATCH CORDS

A. Supply patch cords equal to 1.1 times the number of cables terminated in the communication room(s).
   1. Provide for installed fiber-optic systems.
   2. Length: As required for connection without strain and ability to service equipment.

B. Patch Cords, Singlemode Fiber:
   1. Assemblies consisting of flexible, 9um/125um OS2 rated cable with duplex LC connectors at each end.

2. Cable shall be label-verified.
3. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
4. Patch cords shall have crossover orientation.
5. Patch cords shall be unkeyed.
6. Patch cords shall be factory assembled.
7. Patch cords shall be yellow.

2.6 LABELING AND COLOR CODING

A. Labels shall be developed by the contractor and approved by the City.
   1. Labels shall be machine printed on opaque or clear tape, stenciled onto adhesive labels.
   2. Handwritten labeling is unacceptable.

B. Cable and Jacks:
   1. Voice: White.
   2. Data: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown.

B. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be coordinated with the local communications provider(s).

C. Components shall be labeled in accordance with TIA/EIA/ANSI 606.

D. Penetrations in fire-rated construction shall be firestopped.

E. Wiring shall be installed in accordance with TIA/EIA/ANSI Standards.
   1. Wiring, and terminal blocks and outlets shall be marked in accordance with TIA/EIA/ANSI 606.

F. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables.

G. Pathway System:
   1. Provide in accordance with TIA 569 and NFPA 70.
   2. Provide conduits in accordance with 26 05 33 - Raceways and Boxes.
   3. Provide grounding of raceways and cable tray in accordance with TIA 607 and NFPA 70.

H. Fiber Optic Patch Panels:
   1. Patch panels shall be mounted in dedicated enclosures with sufficient connectors to accommodate the installed cable plant.
   2. Cable guides shall be provided above, below and between each panel.

I. Backbone and Horizontal Distribution Cable:
   1. Cable pulling tension shall not be exceeded.
   2. Cable shall not be stressed such that twisting, stretching or kinking occurs.
   3. Cable shall not be spliced.
   4. All backbone cable shall be installed in conduit or microduct.
   5. Cable shall not be run through structural members or in contact with conduits, pipes, ducts, or other potentially damaging items.
   6. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.
   7. Cables shall be terminated; no cable shall contain unterminated elements.
   8. Minimum bending radius shall not be exceeded during installation or once installed.

9. Only fabric hook and loop fasteners shall be used to wrap cables, 1/2 inches width minimum. Plastic or nylon cable ties shall not be used.

3.2 TERMINATION

A. Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles.
   1. Manufacturer's minimum bending radius shall not be exceeded.
   2. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.
   3. Fiber Optic Cable:
      a. Each pair shall be terminated with appropriate connectors.
      b. No cable shall be unterminated or contain unterminated elements.

3.3 LABELING

A. All cables will be labeled using color labels on both ends per TIA/EIA/ANSI 606.

B. All workstation and patch panel connections will be labeled using color coded labels per TIA/EIA/ANSI 606.

3.4 TESTING

A. Testing shall conform to the TIA/EIA/ANSI Standards for all test parameters.
   1. All test data sheets shall be downloaded from the tester, printed out and provided to the City.
   2. Provide City with all test results as Electronic Documents (in portable document format, PDF files) by Electronic Means.
   3. Tester shall be capable of testing parameters for the warranted system.

B. Materials and documentation to be furnished under this Specification are subject to inspections and tests.
   1. All components shall be terminated prior to testing.
   2. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

C. Fiber Optic Cable:
   1. Unless stated otherwise, tests on all fiber strands shall be performed from both ends of each circuit.
   2. All terminations shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist.
   3. Each link shall be tested for insertion loss using a light source similar to that used for the intended communications equipment.
   4. High-resolution optical time domain reflectometer (OTDR) tests shall be performed for each fiber. OTDR test results shall be provided to the Engineer prior to patching cables in the patch panel.
   5. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80% of the X-axis.

END OF SECTION

DIVISION 31

EARTHWORK

SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, trenching, backfilling and compacting for all underground utilities.
2. Fiber optic microduct system.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 26 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/FT^3 (600 kN-M/M^3)).
   b. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   c. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
2. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
3. Submit sieve analysis reports on all granular materials.

1.5 SITE CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.

1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by City to prevent serious interruption of travel.

C. Protect and maintain benchmarks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of City and controlling agency.

D. Verify location of existing underground utilities

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:

1. As approved by Engineer.
    a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
    b. Moisture content at time of placement: ±3% of optimum moisture content as specified in accordance with ASTM D698.

B. Bedding Materials:

1. Granular bedding materials:
    a. Granular material is generally utilized as follows:
        1) PVC, FRP, PE, steel pipe and ABS truss embedment.
        2) Trench stabilization.
    b. Two general gradation classifications used for granular bedding are:
        1) Uniformly graded
        2) Well graded.
    c. ASTM D2321 Class 1B.
        1) Well-graded crushed stone.
    d. ASTM C33/C33M, gradation 67 (3/4 inches to No. 4 sieve) defined below:

Sieve Size	1 inches	3/4 inches	3/8 inches	No. 4	No. 20
Percent Passing by Weight	100	90-100	20-55	0-10	0

        1) Well-graded crushed stone.
        2) Well graded crushed gravel.
        3) Well graded gravel.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials as directed to site provided by City.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone.

B. Excavation for Appurtenances:

1. 12 inches (minimum) clear distance between outer surface and embankment.

C. Trench Excavation:

1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
    a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
        1) Stabilize excavation to prevent undermining of existing utility and yard piping.
2. Open trench outside buildings, units, and structures:
    a. No more than the distance between two handholes, , structures, units, or 300 LF, whichever is less.
    b. Field adjust limitations as weather conditions dictate.

3. Any trench or portion of trench, which is opened and remains idle for seven calendar days, or longer, as determined by the City, may be directed to be immediately refilled, without completion of work, at no additional cost to City.
    a. Said trench may not be reopened until City is satisfied that work associated with trench will be prosecuted with dispatch.
4. Observe following trenching criteria:
    a. Trench size:
        1) Excavate width to accommodate free working space.
        2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 inches and less	18 inches
more than 33 inches	24 inches

        3) Cut trench walls vertically from bottom of trench to 1 foot above top of pipe, conduit, or utility service.
        4) Keep trenches free of surface water runoff.
            a) Include cost in Bid.
            b) No separate payment for surface water runoff pumping will be made.

D. Trenching for Fiber Optic Installations:

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
2. Modify for fiber optic installations as follows:
    a. Open no more than 600 linear foot of trench in exterior locations for trenches more than 12 inches but not more than 30 inches wide.
    b. Any length of trench may be opened in exterior locations for trenches which are 12 inches wide or less.
    c. Do not over excavate trench.
    d. Cut trenches for fiber optic runs with minimum 30 inches cover, unless otherwise specified or shown on Drawings.
    e. See Division 26 for additional requirements.

3.3 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.

B. Common Trench Backfill:

1. Perform in accordance with the following:
    a. Place backfill in lift thicknesses capable of being compacted to densities specified.
    b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
    c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

C. Water flushing for consolidation is not permitted.

D. Backfilling for Fiber Optic Installations:

1. Observe the preceding Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.

2. Modify for fiber optic installation as follows:
    a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.4 COMPACTION

A. General:

1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:

1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
    a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75% relative density by ASTM D4253 and ASTM D4254

    b. Toe drain bedding and backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	60% relative density by ASTM D4253 and ASTM D4254

    c. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	95% of maximum dry density by ASTM D698
	Cohesionless soils	60% of relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded, plant seeded, nontraffic areas	Cohesive soils	85% of maximum dry density by ATM D698
	Cohesionless soils	40% of relative density by ASTM D4253 and ASTM D4254

3.5 FIELD QUALITY CONTROL

A. Testing:

1. Perform in-place moisture-density tests as directed by the City.
2. Perform tests through recognized testing laboratory approved by City.
3. Costs of "Passing" tests paid by City.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by City and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure City has immediate access for testing of all soils related work.

8. Ensure excavations are safe for testing personnel.

END OF SECTION

DIVISION 40

PROCESS INTERCONNECTIONS

SECTION 40 61 13
PROCESS CONTROL SYSTEM GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for complete instrumentation system for process control.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 10 14 00 - Identification Devices.
   2. Section 40 67 00 - Control System Equipment Panels and Racks.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. The International Society of Automation (ISA):
      a. 7.0.01, Quality Standard for Instrument Air.
      b. S5.1, Instrumentation Symbols and Identification.
      c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
      d. 62443-3-3 Security for Industrial Automation and Control Systems, Part 3-3: System Security Requirements and Security Levels
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   4. National Institute of Standards and Technology (NIST)
      a. SP 800-82, Guide to Industrial Control Systems (ICS) Security

B. Miscellaneous:
   1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

1.3 SYSTEM DESCRIPTION

A. Control System Requirements:
   1. This Specification Section provides the general requirements for the control system.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Submittals shall be original printed material or clear unblemished photocopies of original printed material.
      a. Facsimile information is not acceptable.
   2. Limit the scope of each submittal to one Specification Section.
      a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
      b. Do not provide any submittals for Specification Section 40 61 13.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Equipment catalog cut sheets.
      c. Instrument data sheets:
         1) ISA S20 or approved equal.
         2) Separate data sheet for each instrument type.
      d. Materials of construction.
      e. Physical limits of components including temperature and pressure limits.
      f. Size and weight.
      g. Electrical power requirements and wiring diagrams.
      h. NEMA rating of housings.

i. Submittals shall be marked with arrows to show exact features to be provided.

4. Comprehensive asset inventory of all networked components:
   a. Provide in Excel spreadsheet format.
   b. Coordinate with the City or Engineer to determine the preferred method of delivery to assure security of information contained in asset inventory.
   c. Include:
      1) Device ID.
      2) Manufacturer.
      3) Model Number.
      4) Serial Number.
      5) IP Address.
      6) Device Use description.
      7) Firmware.
5. Refer to Section 01 81 33 – Cyber Security Requirements for other required cyber security related submittals.
6. Panel fabrication drawings as specified in Section 40 67 00.
7. Nameplate layout drawings.
8. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
   a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
9. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
   a. Furnish electronic files on owner's designated electronic media.
   b. Drawings in AUTO CAD format.
10. Certifications:
    a. Documentation verifying that calibration equipment is certified with NIST traceability.
    b. Approvals from independent testing laboratories or approval agencies, such as UL, FM or CSA.
       1) Certification documentation is required for all equipment for which the specifications require independent agency approval.
11. Testing reports: Source quality control reports.

B. Qualifications Submittal:
   1. Documentation verifying contractor/subcontractor adherence to specified certifications and qualifications

C. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 79 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
   2. All Shop Drawings shall be modified with as-built information/corrections.
   3. Instrumentation and Control Equipment Operation and Maintenance Manual Content:
      a. Provide the following detailed information:
         1) Use equipment tag numbers from the Contract Documents to identify equipment and system components.
         2) As-constructed fabrication or layout drawings and wiring diagrams.
         3) As-constructed network asset inventory.
            a) Coordinate with the City or Engineer to determine the preferred method of delivery to assure security of this information.
      b. Additional information as required in the associated equipment or system Specification Section.
   4. Warranties: Provide copies of warranties and list of factory authorized service agents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

PART 2 - PRODUCTS

2.1 NEMA TYPE REQUIREMENTS

A. Provide enclosures/housing for control system components in accordance with the area designations provided on the Drawings.

1. Areas designated as wet and/or corrosive, outdoors, or where indicated on the Drawings: NEMA Type 4X (stainless steel).
2. Either architecturally or non-architecturally finished areas designated as dry, noncorrosive, and nonhazardous, or where indicated on the Drawings: NEMA Type 12.

2.2 ACCESSORIES

A. Provide identification devices for instrumentation system components in accordance with Specification Section 10 14 00.

B. Provide corrosion resistant spacers to maintain 1/4 inches separation between equipment and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Clarifiers, Digesters, Reservoirs, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.

B. Install electrical components per the requirements of the Electrical design.

3.2 FIELD QUALITY CONTROL

A. See Section 01 75 00.

3.3 CLOSEOUT ACTIVITIES

A. Refer to Section 01 81 33 – Cyber-Security Requirements for cyber security related closeout requirements.

END OF SECTION

SECTION 40 67 00
CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for control panels and enclosures utilized as follows:
      a. Unless noted otherwise, all control panels and enclosures housing control components that are specified in Division 40 and Division 27 Specifications.
      b. This Section is only applicable to panels furnished with equipment specified in other specification divisions when so stated in the applicable equipment specification section.

B. Related Sections include but are not necessarily limited to:
   1. Section 10 14 00 - Identification Devices.
   2. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   3. Section 40 61 13 - Process Controls Systems General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI).
   2. ASTM International (ASTM):
      a. B75, Standard Specification for Seamless Copper Tube.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 4, Industrial Control and Systems: Terminal Blocks.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 409, Industrial Control Panels.
         2) Article 504, Intrinsically Safe Systems.
   5. Underwriters Laboratories, Inc. (UL):
      a. 508A, Standard for Safety Industrial Control Panels.

B. Qualifications:
   1. See Section 40 61 13 - Process Control Systems General Requirements.

1.3 DEFINITIONS

A. Panel: Control panels or enclosures listed in the schedule included in this Specification Section.

B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.

C. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

D. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
   2. Instrumentation cable is typically either TSP (twisted-shielded pair) or TST (twisted-shielded triad), and is used for the transmission of low current or low voltage signals.

E. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.

F. Programmable Logic Controller (PLC): A specialized industrial computer using programmed, custom instructions to provide automated monitoring and control functions by interfacing software control strategies to input/output devices.

G. Remote Terminal Unit (RTU): An industrial data collection device designed for location at a remote site, that communicates data to a host system by using telemetry such as radio, dial-up telephone, or leased lines.

H. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.

I. Supervisory Control and Data Acquisition (SCADA): Used in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by computer workstations.

J. Highway Addressable Remote Transducer (HART): a bi-directional communication protocol that provides data access between intelligent field instruments and host systems.

K. Digital Signal Cable: Used for the transmission of digital communication signals between computers, PLCs, RTUs, etc.

L. Uninterruptible Power Supply (UPS): A backup power unit that provides continuous power when the normal power supply is interrupted.

M. Loop Calibrator: Portable testing and measurement tool capable of accurately generating and measuring 4-20mA DC analog signals.

1.4 SUBMITTALS

A. See Section 40 61 13.

B. Shop Drawings:
1. Table of contents sheet(s).
2. Legend and abbreviation sheets.
3. Panel exterior layout drawings.
4. Panel interior layout drawings.
5. Bill of Material for each panel.
6. Climate control calculations for panels located outdoors.

C. Product Data:
1. Manufacturer catalog cut sheets for enclosure, finish, panel devices, control auxiliaries, and accessories.

D. Informational Submittals:
1. Unwitnessed Factory Testing confirmation of completion.
2. Record Drawings:
   a. Updated panel drawings delivered with the panel(s) from the Contractor's factory.
   b. Drawings shall be enclosed in transparent plastic and firmly secured within each panel.

1.5 SUBMITTAL DOCUMENTATION REQUIREMENTS

A. Shop Drawings:
1. Prepared with computer aided design (CAD) software.
2. Printed on 11 by 17 inches sheets.
3. Drawings shall include a title block containing the following:
   a. Plant or facility name where panel(s) are to be installed.
   b. Drawing title.
   c. Drawing number.
   d. Revision list with revision number and date
   e. Drawing date.
   f. Drawing scale.
   g. Manufacturer name, address, and telephone number.
4. Cover sheet for each drawing set shall indicate the following:
   a. Plant or facility name.
   b. Project name.
   c. Submittal description.

d. Revision number.
e. Issue date.

5. Table of contents sheet(s) shall indicate the following for each drawing in the set:
   a. Drawing number.
   b. Drawing title.
   c. Sheet number.
6. Legend and abbreviation sheets shall indicate the following:
   a. Description of symbols and abbreviations used.
   b. Panel construction notes including enclosure NEMA rating, finish type and color, wire type, wire color strategy, conductor sizes, and wire labeling strategy.
   c. Confirmation that the panel(s) are to be affixed with a UL 508A or UL 698A label prior to shipment from the factory.
7. Bill of Material for each panel shall include the following component information:
   a. Instrument tag number.
   b. Quantity.
   c. Functional name or description.
   d. Manufacturer.
   e. Complete model number.
   f. Size or rating.
8. Panel exterior layout drawings to scale and shall indicate the following:
   a. Panel materials of construction, dimensions, and total assembled weight.
      1) All dimensions shall be in inches.
   b. Panel access openings.
   c. Conduit access locations.
      1) Ensure conduit entry locations allow for sufficient bend radius of field cables entering enclosure.
      2) Control panel exterior layout shall identify conduit and cable entry locations.
   d. Front view, side views and top view of enclosure.
   e. Front panel device layout.
   f. Nameplate schedule:
      1) Nameplate location.
      2) Nameplate dimensions.
      3) Legend which indicates text, letter height and color, background color and nameplate material.
      4) Include exterior legends as per UL requirements.
9. Panel interior layout drawings shall be drawn to scale and shall indicate the following:
   a. Sub-panel or mounting pan dimensions.
      1) All dimensions shall be in inches.
   b. Interior device layouts indicating dimensioned location of devices.
   c. Fiber patch panels general arrangement layouts.
   d. Wire-way locations, purpose, and dimensions. Include center line dimensions for all DIN rail and wire-way.
   e. Terminal strip designations.
   f. Include interior legends as per UL requirements.

B. Verify that panel door mounted equipment will not exceed the maximum allowed weight as per manufacturer's specification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Enclosures:
      a. Hoffman Engineering Co.
      b. Hammond Manufacturing.

c. Saginaw Control and Engineering.
d. Rittal

2. Internal corrosion inhibitors:
   a. Hoffman Enclosures, Inc.; Model A-HCI10E
   b. Northern Technologies International Corporation (NTIC); Model Zerust VC.
   c. Cortec Corporation; Model VpCl Emitting Systems.

2.2 ACCESSORIES

A. Panel Nameplates and Identification:
   1. See Section 10 14 00.

B. All field instrument enclosure penetrations shall be plugged using threaded conduit plugs to prevent water or contaminant entry into the enclosure during installation.
   1. Instruments shall maintain manufacturer's rating for the appropriate area designation.
   2. Tape and/or plastic plugs shall not be an acceptable means of preventing water/contaminate intrusion.

2.3 FABRICATION

A. General:
   1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.
   2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents.
   3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.
      a. Devices that cannot be obtained with an adequate NEMA rating shall be installed behind a transparent viewing window.
      b. The window shall maintain the required NEMA rating of the enclosure.
   4. Externally mounted components including but not limited to air conditioners, enclosed transformers, external disconnect switches and external surge protector boxes shall match the NEMA rating and be constructed of the same material as the control panel. As an illustrative example, a NEMA 3/3R external enclosed transformer shall not be mounted on a NEMA 4X stainless steel panel.
   5. Panel(s) shall be completely assembled at the Contractor's factory.
      a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.
   6. Painting:
      a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted.
         1) Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.
         2) Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.
         3) Utilize solvent or chemical methods to clean panel surfaces.
         4) Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.
         5) Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.
         6) Bake powder coating at high temperatures to bond coating to enclosure surface.
            a) Panel interior shall be white with semi-gloss finish.
            b) Panel exterior shall be ANSI #61 gray with flat finish.
         7) Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 1 or NEMA 12 rated panels.
      b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.
   7. Finish opening edges of panel cutouts to smooth and true surface conditions.
      a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.

B. Wall Mounted Panels:
   1. Seams continuously welded and ground smooth.
   2. Rolled lip around all sides of enclosure door opening.
   3. Gasketed dust tight.
   4. Door clamps and hasp/staple for padlocking.
   5. Key doors alike.
   6. Continuous heavy GA hinge pin on doors.
      a. Hinges rated for 1.5 times door plus instrument weight.
   7. Front full opening door.
   8. Brackets for wall mounting.

C. Internal Panel Wiring:
   1. Utilize fiber optic cable management accessories within the panel.
      a. Terminate Fiber optic cable from field in fiber optic patch panel. Terminate all fibers within the cable. Connect Fiber optic patch cords from the fiber optic patch panel to the fiber optic Ethernet switch.
   2. Arrange wiring neatly, cut to proper length, with surplus wire removed.
      a. Arrange wiring with sufficient clearance.
      b. Provide abrasion protection for wire bundles that pass through openings or across edges of sheet metal.
   3. Wire and cable identification:
      a. Wire and cables numbered and tagged at each termination.
      b. Wire tags:
         1) See Section 10 14 00 - Identification Devices.

D. Environmental Controls:
   1. Environmental control components:
      a. Internal corrosion inhibitors:
         1) Contains chemical which vaporizes and condenses on surfaces in the enclosure.
         2) Inhibitor shall be applied in accordance with manufacturer instructions for the enclosure volume.
         3) Inhibitor shall be applied in the panel(s) prior to shipment from the Contractor's factory.

2.4 MAINTENANCE MATERIALS

A. Extra Materials:
   1. One complete set of replacement corrosion inhibitors in sealed packages for each panel.
   2. Quantity of 25% of the total fiber patch cords used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor panels in a manner to prevent the enclosure from racking, which may cause the access doors to become misaligned.

B. Obtain approved panel layouts prior to installation of conduits.

C. Install products in accordance with manufacturer's instructions.

END OF SECTION