

JOB REQUIREMENTS
WP-316: LINNWOOD OZONE BY-PASS VALVES

JR-1 **FORM OF BID:** Contractor shall submit a lump sum bid (including all bid allowances) for furnishing the complete job in accordance with plans and specifications.

JR-2 **JOB LOCATION:** The Linnwood Purification Plant is located at 3000 North Lincoln Memorial Drive, Milwaukee, Wisconsin, 53211.

JR-3 **GENERAL DESCRIPTION OF WORK:** The work to be performed under the provisions of this contract and as set forth in these documents consists of the supply and installation of all materials, labor, supervision and rentals for all work involved and described below.

LINNWOOD OZONE BY-PASS VALVES:

Supply and installation of all material and labor required for improvements to the Work shall include site, mechanical, electrical and structural work as shown on the drawings.

JR-4 **CONTRACT DRAWINGS:** The contract drawings upon which the proposal is to be based are listed hereunder:

<u>Drawing No.</u>	<u>Title</u>
WP-316-01	LOCATION MAP – DRAWING INDEX
WP-316-02	PUMP ROOM PLAN AND PIPING
WP-316-03	VALVE PIT #1 – PLAN AND SECTIONS
WP-316-04	VALVE PIT #2 – PLAN AND SECTIONS
WP-316-05	VALVE LOCATION PLAN
WP-316-06	VALVE #3 – PLAN AND SECTIONS
WP-316-07	VALVE #4 – PLAN AND SECTIONS
WP-316-08	VALVE #5 – PLAN AND SECTIONS
WP-316-09	ELECTRICAL WORK – PLAN AND ELEVATION

JR-4.1 **REFERENCE DRAWINGS:** The following reference drawings are the original construction drawings. These are included here for **general information only**. The drawings are assumed to be accurate; however, **the CONTRACTOR is responsible for field verification of any and all dimensions essential to the work.**

<u>Reference Drawing No.</u>	<u>Title</u>
WP 18-02	Front Building Substructure Layout & Dimensions
WP 18-03	Front Building Substructure Excavation Plan
WP 18-04	Pump Building General Plan And Sections
WP 18-05	Pump Building Substation Foundations
WP 18-18	Pipe Encasement – Pump House Walls & Manholes
WP 27-01	Pump Piping Low Level Discharge
WP 27-04	Pump Piping, Runs Under Chemical Building
WP 27-05	Pump Piping Discharge Header, East Half
WP 27-06	Pump Piping Discharge Header, west Half
WP 140-1	Pump Room Control Wiring to Load Center

WP 140-2	Main Aisle East Entrance
WP-235-10	Ozone Facilities – Site Work
WP-235-11	Ozone Facilities – Junction Structures “A” & “B”
SB-97-18-D18	Cretex Pressure Pipe Yard Layout

JR-5 PRE-BID MEETING: A **MANDATORY** Pre-Bid Meeting is scheduled for Tuesday, March 5, 2013 at 10:00AM in the Linnwood Water Purification Plant Conference Room; 3000 North Lincoln Memorial Drive, Milwaukee, WI 53211. The City of Milwaukee will **ONLY** receive bids from prospective bidders who are in attendance at the **MANDATORY** Pre-Bid Meeting.

The official envelope for submitting a bid and bid bond form will be available at the **MANDATORY** Pre-Bid Meeting. All attendees are required to e-mail Anthony.Fahres@milwaukee.gov, AND Anthony.Supinski@milwaukee.gov at least 24 hours in advance of the **MANDATORY** Pre-Bid Meeting to be placed on the visitor list for access to the Linnwood Water Purification Plant.

JR-6 PRE-CONSTRUCTION MEETING: Within **ten (10) business days** after Notice to Proceed is issued, a pre-construction meeting will be held at the job site. Construction details of the project will be discussed in the meeting.

JR-7 JOB SCHEDULE: Within **ten (10) business days** after Notice to Proceed is issued, the contractor shall submit a construction schedule for approval. The schedule shall be made in sufficient detail to indicate dates of each significant operation. The schedule shall be such that the entire job will be completed within the specified completion time. **Contractor shall submit the construction schedule in hard copy and electronic format using Microsoft Project 2010. However, if an electronic copy cannot be provided in this format, a copy shall be transmitted electronically in a .PDF format and a hard copy of any updated schedules must be provided at all progress meetings.**

JR-8 COMPLETION DATE: All work on this project shall be completed according to the following schedule:

No Work Shall Begin Before :	<u>“NOTICE TO PROCEED”</u>
Project Phase 1 Completion:	Friday, December 20, 2013
Project Final Completion:	Friday, June 20, 2014

JR-9 CHARGE FOR INSPECTION: The Contractor will be charged \$350.00 per day per inspector for each and every day inspection is required on this Contract after the date allowed for completion or after such extension of time as may have been granted. This charge is further defined in Section 2.5.11 of the Department of Public Works (DPW) General Specifications.

JR-10 PROGRESS PAYMENTS: Within **ten (10) business days** after the Notice to Proceed is issued, the contractor shall submit to the City for approval a schedule showing the breakdown of the contract with quantities and prices as a basis for checking and computing progress estimates. The values shown in the approved breakdown shall be used for pay purposes only and shall not be used as a basis for additions to or deductions from contract work.

When the contractor proceeds properly and with diligence to perform and complete the work on this contract, the Commissioner of Public Works may, from time to time as the work progresses, grant to the contractor an estimate of the amount already earned. In making such progress estimates, there shall be retained 5.0% of each progress estimate until final completion and acceptance of the work; except that after 50% of the work has been completed and the Commissioner finds that satisfactory progress is being made and all conditions complied with, he may authorize any of the remaining progress payments to be paid in full to the contractor with no amount retained.

In accordance with Charter Ordinance 7.26 as amended 6-1-72, payment for materials delivered to the work or storage site may be authorized by the Commissioner of Public Works providing the following terms and conditions are met:

- A. The work is progressing properly and such materials as specified are properly stored and suitable for permanent incorporation in the work. Field Engineer shall verify that material is as specified and properly stored.
- B. Materials designated for pay in the next progress estimate after delivery shall be limited to fabricated or manufactured components which are assembled in final form ready for placement in the work.
- C. The following forms shall be submitted with requests for payment:
 - 1. Progress Estimate and Request for Payment for Fabricated Materials or Components Properly Stored.
 - 2. Certification of the Contractor or his duly authorized representative.
- D. The contractor shall be responsible for the safeguarding of any such materials against loss or damage whatsoever, and in the case of any loss or damage, the contractor shall replace such lost or damaged materials at no cost to the City. The Commissioner shall reserve the right to deduct from ensuing progress estimates the value of any lost or damaged materials until the contractor restores such loss or damage.
- E. The Commissioner may limit processing progress estimates to those cases where the amount earned in any pay period for work and materials is \$5,000 or more.
- F. Any materials for which payment has been made shall not be removed from the work or storage site without the specific written approval of the Commissioner of Public Works.

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 - SCOPE OF THE CONTRACT

1.01 CONTRACT DESCRIPTION

- A. This contract includes the furnishing and installation of all equipment, labor, supervision, materials and appurtenances for and in connection with improvements to Linnwood Water Purification Plant.

1.02 MECHANICAL IMPROVEMENTS

- A. The work covered by this part of the specification shall consist of, but not be limited to, the furnishing of all material, labor, equipment, and supervision for the following:

1. Valve #1: East Raw Water Conduit to North Coagulation Basin
 - a) Demolish and remove part of the existing concrete foundations where the old switchgear was located as indicated on the drawings.
 - b) Excavate and expose the existing valve pit and steel piping on the North and South ends of the pit.
 - c) Saw cut and remove concrete roof of the valve pit and portions of the North and South pit walls to facilitate removal of existing piping and valve. Note that existing steel pipe beyond pit is concrete encased, 12" thick approximate.
 - d) Remove existing 60" butterfly valve (BFV), Dutchman flanges and piping as indicated on the drawings.
 - e) Re-coat the interior and exterior of the existing steel piping where cut for removal.
 - f) Install new fabricated steel piping and fittings to accommodate new 60" BFV and electric operator.
 - g) Replace and repair concrete roof and walls of the valve pit and encase new pipe in concrete.
 - h) Install new electrical as required for lighting, valve operator and SCADA signal wiring.
2. Valve #2: West Raw Water Conduit to South Coagulation Basin
 - a) Excavate and expose the existing valve pit and steel piping on the North and South ends of the pit.
 - b) Saw cut and remove concrete roof of the valve pit and portions of the North and South pit walls to facilitate removal of existing piping and valve. Note the existing pipe is concrete encased, 12" thick approximate.

- c) Remove existing 60" butterfly valve (BFV), Dutchman flanges and piping as indicated on the drawings.
 - d) Re-coat the interior and exterior of the existing steel piping where cut for removal.
 - e) Install new fabricated steel piping and fittings to accommodate new 60" BFV and electric operator.
 - f) Replace and repair concrete roof and walls of the valve pit and encase new pipe.
 - g) Install new electrical as required for lighting, valve operator and SCADA signal wiring.
3. Valve #3: Raw Water Main to Ozone
- a) Excavate, expose and remove sections of existing 120" diameter PCCP underground piping to accommodate valve installation.
 - b) Prepare bedding material for installation of new pipe and fittings.
 - c) Install new 72" Direct Bury BFV and associated PCCP fabricated pipe fittings to accommodate the valve installation.
 - d) Supply and install valve box, operator rods, extension couplings, and valve position indicator.
4. Valve #4: Ozonated Water Isolation to South Coagulation Basin
- a) Excavate, expose and remove sections of existing 90" diameter PCCP underground piping.
 - b) Prepare bedding material for installation of new pipe and fittings.
 - c) Install new 72" BFV and associated PCCP fabricated pipe fittings to accommodate the valve installation.
 - d) Supply and install valve box, operator rods, extension couplings, and valve position indicator.
5. Valve #5: Ozonated Water Isolation To North Coagulation Basin
- a) Excavate, expose and remove sections of existing 78" diameter PCCP underground piping.
 - b) Prepare bedding material for installation of new pipe and fittings.
 - c) Install new 72" BFV and associated fabricated pipe fittings to accommodate the valve installations.
 - d) Supply and install valve box, operator rods, extension couplings, and valve position indicator.

1.03 CONSTRUCTION SEQUENCE

- A. Construction sequence, subject to change, is as follows:
1. Valves #1 and #5 are to be done first to allow the plant to operate while the North Coagulation Basins are out of service. This work is anticipated to be started in September of 2013 and completed by January of 2014.
 2. Valves #2, #3, and #4 need to be done sequentially second to allow the plan to operate while the South Coagulation Basins are out of service and without Ozonation. This is work is anticipated to be started in April of 2014 and completed by June of 2014. It is critical the contractor include this requirement into the overall project schedule.

1.04 LEAD PAINT:

- A. The contractor is responsible for and shall take any and all precautions necessary for the safe removal of any existing piping and valve parts and other items containing lead based paint. The removal plan shall be submitted to and approved by the City.

1.05 QUALIFICATIONS

- A. The new valves, operators, instrumentation, and all piping and fittings as specified shall be standard equipment manufactured by a company with no less than ten (10) years experience in the manufacturing of such equipment. Upon request by the Project Engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, catalogue cuts, reference lists etc.

1.06 SPECIFICATIONS AND STANDARDS

- A. All materials, general design, design loads, allowable stresses, joint design, shop fabrication and field construction shall conform to the requirements of the following latest standard specifications of any technical society, organization, or association, or to codes of local or state authorities:
1. NEC, National Electric Code
 2. NEMA, Standards of National Electrical Manufacturers Association
 3. IEEE, Institute of Electrical and Electronic Engineers.
 4. ASTM, American Society for Testing and Material
 5. EPA, United States Environmental Protection Agency
 6. AWWA, American Water Works Association
 7. AFBMA, Anti-Friction Bearing Manufacturers Association
 8. ANSI, American National Standards Institute
 9. SSPC, Steel Structures Painting Council
 10. CRSI, Concrete Reinforcing Steel Institute
 11. ACI, American concrete Institute
 12. The Wisconsin Administrative Code

13. OSHA, U.S. Department of Labor Occupational Safety and Health Act
 14. National Electric Motor Association
 15. ACPA, American concrete Pipe Association
 16. ACPPA, American Concrete Pressure Pipe Association
- B. The contractor shall be familiar with the requirements of the above agencies. Any conflict in the contract drawings, these specifications, the contractor's design or construction methods shall result in this contractor performing in a manner which conforms to the applicable requirements.

1.07 SHOP DRAWINGS AND SUBMITTALS

- A. Within three (3) weeks after Notice to Proceed is issued, the contractor shall submit to the City of Milwaukee (City) for approval a minimum three (3) copies of all shop, fabrication, assembly, other drawings and engineering data required by the specifications; all drawings of equipment and devices offered by the contractor; all drawings showing essential details of any change in design or construction proposed by the contractor; and all necessary wiring and piping layouts. Drawings of equipment and devices shall show sufficient detail to adequately depict the construction and operation of each item.
- B. Each shop drawing shall bear City of Milwaukee, the name and location of the project, job number, the name of the contractor, the date of the drawing, the date of each correction or revision, and the specification numbers and plan sheet numbers applicable thereto.
- C. Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, contractor's initial submittal shall be complete including all components.
- D. Each submittal shall indicate the intended use of the item in the work. When catalog pages or cut sheets are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.
- E. Three (3) revised copies of each drawing shall be submitted each time a drawing is returned to the contractor for revision. Upon final approval of a drawing, eight (8) copies shall be submitted to the City for record and distribution to authorized persons.
- F. After reviewed by the City, all such drawings shall become a part of the contract documents and the work or equipment shown thereby shall be furnished and installed as shown unless otherwise required by the City. No work shall be performed or equipment manufactured until drawings have been approved. The review of drawings submitted by the contractor will be for, and will cover only general conformity to the plans and specifications and will not constitute a blanket approval of all dimensions, quantities, or details of the material or equipment shown by such drawings, nor shall such approval relieve the contractor of responsibility for errors contained therein.

- G. At the completion of work and prior to final payment, the contractor shall provide the City with six (6) sets of "as-built" drawings for the completed job showing all new equipment and piping. All concealed piping, conduit or similar items shall be located by dimensions and elevations. The contractor will be responsible for the accuracy of these drawings. Two (2) copies of the above "as-built" drawings shall be submitted in an electronic format compatible with the latest edition of MICROSTATION® (currently V8).

1.08 WARRANTY AND GUARANTEE

- A. The contractor shall furnish a written two (2) years warranty from the date of official acceptance against defective materials or workmanship before the final payment is made.
- B. During the period of two (2) years from and after the date of the final acceptance by the City of the work embraced by this contract, the contractor shall make all needed repairs arising out of defective workmanship or materials, or both, which in the judgment of the Commissioner of Public Works (Commissioner), shall become necessary during such period.
- C. Whenever defective equipment or materials are replaced, the equipment or materials shall be guaranteed for one (1) year from the date that the replacement is performing satisfactorily.
- D. If within ten (10) business days after mailing of a notice in writing to the contractor, or his agent, the said contractor shall neglect to make, or undertake with due diligence to make, the aforesaid repairs, the City is hereby authorized to make such repair at the contractor's expense; providing, however, that in case of an emergency where, in the judgment of the Commissioner, delay would cause serious loss or damage, repairs may be made without notice being sent to the contractor, and the contractor shall pay the cost thereof.
- E. The contractor shall also furnish written guarantees as required by each section. Length of time and requirements of guarantees, if applicable, are specified in each section. Each guarantee shall commence on the date of official acceptance. Final payment will not be paid until the City receives all guarantees.

1.09 EROSION CONTROL IMPLEMENTATION PLAN

- A. Section 02200 Earthwork, contains requirements for completing and submitting an Erosion Control Implementation Plan for review and approval by the City.

END OF SECTION

SECTION 01039
COORDINATION AND MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Coordination
- B. Alterations
- C. Cutting and patching
- D. Pre-construction conference
- E. Progress meetings
- F. Pre-installation conferences

1.02 COORDINATION

- A. Coordinate scheduling, submittals and work on the various sections of the specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify that the City of Milwaukee (City) requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to and placing in service, such as equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work. Follow routing shown for pipes and conduit, as closely as practicable; place runs parallel with lines of structures. Utilize spaces efficiently to maximize accessibility for other installations, maintenance and repairs.
- D. Coordinate completion and clean up of work of separate sections in preparation for substantial completion.
- E. Coordinate correction of defective work and work not in accordance with contract documents in order to minimize disruption of the City's activities.

1.03 ALTERATIONS

- A. Materials: As specified in product sections, match existing products and work for patching and extending work.
- B. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature, humidity and precipitation.
- C. Remove, cut and patch work in a manner to minimize damage to and provide a means of restoring products and finishes to original condition.
- D. Refinish visible existing surfaces to original condition.
- E. Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work shall match existing adjacent work in texture and appearance.

- F. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to the City.
- G. Patch or replace portions of existing surfaces which are damaged, lifted, discolored or showing other imperfections.
- H. Finish surfaces as specified in individual product sections.

1.04 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements which affects:
 1. Structural integrity of element.
 2. Integrity of weather-exposed or moisture resistant element.
 3. Efficiency, maintenance or safety of element.
 4. Visual qualities of sight-exposed elements.
 5. Work of City or separate contractor.
- C. Execute cutting, fitting and patching to complete work, and to:
 1. Fit the several parts together, to integrate with other work.
 2. Uncover work to install or correct ill-timed work.
 3. Remove and replace defective and non-conforming work.
 4. Remove samples of installed work for testing.
 5. Provide openings in elements of work for penetrations of mechanical and electrical work.
 6. Execute work by methods that will avoid damage to other work, and provide proper surfaces to receive patching and finishing.
 7. Cut rigid materials using masonry saw or core drill.
 8. Restore work with new products in accordance with requirements of contract documents.
 9. Fit work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
 10. Maintain integrity of wall, ceiling or floor construction; completely seal voids.
 11. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.
 12. Identify any hazardous substance or condition exposed during the work to the City.

1.05 PRE-CONSTRUCTION CONFERENCE

- A. City will schedule a pre-construction conference after notice to proceed. A tentative date, time and location will be included in the notice.
- B. Attendance Required: City and prime contractor.
- C. Sample Agenda (subject to change):
 - 1. Submission of executed bonds and insurance certificates (unless previously submitted to DPW directly).
 - 2. Submission of a hard copy list of all subcontractors, schedule of values and project progress schedule. An electronic copy may be forwarded to City contact prior to meeting.
 - 3. Designation of personnel representing the parties in contract.
 - 4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, change orders and contract closeout procedures.
 - 5. Scheduling and reports.
 - 6. Use of premises by City and contractor.
 - 7. Construction facilities and controls provided by City, if any.
 - 8. Temporary utilities and controls provided by City, if any.
 - 9. Security procedures.
 - 10. Procedures for testing.
 - 11. Procedures for start-up of equipment.
 - 12. Requirements for maintaining record documents.
 - 13. Inspection and acceptance of equipment put into service during construction period.
 - 14. Conflicts.

1.06 PROGRESS MEETINGS

- A. The City will schedule and administer meetings throughout progress of the work as required.
- B. The City will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, records minutes and distribute copies within three (3) days to the City, participants and those affected by decisions made.
- C. Attendance Required: Contractor's general superintendent, major subcontractors and suppliers, City, as appropriate to agenda topics for each meeting.
- D. Sample Agenda (subject to change):
 - 1. Review minutes of previous meetings.
 - 2. Review of work

3. Field observations, problems and decisions.
4. Field observations of problems to impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Other business relating to work.

1.07 PRE-INSTALLATION CONFERENCES

- A. When determined by the City, convene a pre-installation conference at work site prior to commencing work.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify all parties four (4) days in advance of meeting date.
- D. Prepare agenda; preside at conferences, record minutes and distribute copies within two (2) days after conference to participants, with one (1) copy to the City.
- E. Review conditions of installation, preparation and installation procedures and coordination with related work.

1.08 COMMENCEMENT OF WORK

- A. No work shall proceed by contractor until City approval has been given to items submitted in Paragraph 1.05, Subparagraph C.2. and C.3. above.
- B. No work shall proceed by contractor until all required Security Forms A and B have been submitted per Section 010500, and approved/placed on the project contractor security roster.

END OF SECTION

SECTION 01500
JOB SITE SECURITY, UTILITIES AND FACILITIES

PART 1 - SCOPE

1.01 INDEX

- A. PART 1 - Scope
- B. PART 2 - Security and Safety
- C. PART 3 – City of Milwaukee Permits
- D. PART 4 - Occupancy during Construction
- E. PART 5 - Electrical Power and Telephone Service
- F. PART 6 – Heat and Ventilation
- F. PART 7 - Water
- G. PART 8 - Toilet Facilities
- H. PART 9 - Deliveries

1.02 GENERAL CONDITIONS

- A. All operations shall be carried on with a minimum of damage and disturbance. All damages shall be repaired to the original condition to the satisfaction of the Water Engineering representative.
- B. All removals become the property of the contractor and shall be disposed of off-site, unless otherwise specified.

1.03 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, dissipate humidity and/or prevent accumulation of dust, fumes, vapors or gases.

1.04 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and protect existing facilities and adjacent properties from damage caused by construction operations and demolition.
- B. Protect non-owned vehicular traffic, stored materials, site and structures from damage.
- C. Utilize road plates to protect underground utilities and structures, and to minimize disturbances caused by construction traffic.

1.05 PROGRESS CLEANING

- A. Waste materials, debris and rubbish shall be removed daily after work. Maintain site in a clean and orderly condition.
- B. Clean and repair damage caused by removals or installations.
- C. Restore existing facilities used during construction to original condition.

PART 2 – SECURITY AND SAFETY

2.01 GENERAL

- A. The Milwaukee Water Works (MWW) consists of a number of facilities to treat and deliver drinking water to the City of Milwaukee (City) and surrounding suburban communities. To ensure the safety and security of drinking water, the MWW has instituted protocols for visitors and contractors to control entry to these facilities. It is essential that contractors strictly comply with the security policy outlined in this specification section.
- B. For this project, the contractor shall continuously coordinate building and site security measures, including accessing the site, with the designated Water Engineering representative or the Water Security Manager, Mr. Michael Schaefer, who can be reached at Telephone: (414) 286-3465 or Facsimile: (414) 286-2672.

2.02 SCOPE

- A. Any and all City agencies and contractors engaged for work at MWW facilities shall be required to attend a "Pre-Construction Security Briefing" before any contracted work can be initiated. At this meeting, the contractor and sub-contractors shall have a detailed briefing with discussions regarding the following items:
 - 1. MWW site security policies and procedures
 - 2. Contractor and subcontractor obligations
 - 3. Permit system

2.03 POLICIES

- A. During the "Security Briefing" portion of the "Pre-Construction Meeting", MWW security staff shall provide the prime contractor with site polices to be reviewed by the prime and subcontractors. These documents may include:
 - 1. Lock-out/Tag-out Policy
 - 2. Confined Space Entry Procedures
 - 3. Evacuation Procedure for Propane, Lox, and Ammonia Releases
 - 4. Personal Protective Equipment Guidelines
 - 5. No Smoking Policy
 - 6. Prohibited Materials
- B. Additionally, the contractor will be provided:
 - 1. Contact phone numbers for MWW staff
 - 2. On-site parking location and designated construction entrance
 - 3. Site security policy and procedures

- C. The prime contractor shall be required to review these documents and is responsible for conveying the contents of these submittals to their employees, subcontractors and any other parties working directly or indirectly for them. These policies apply equally to all contractors. Failure to comply with established policies and procedures may result in access privileges being withdrawn.
- D. MWW staff shall provide a “walk-through” session with the contractor to review area layout and site plans as part of this orientation process and to establish the specific work areas necessary for the contractors to perform their scope of work. Topics covered in this session include: site overview with hazards, Material Safety Data Sheets (MSDS), fire extinguisher placement and the storm water protection policy.

2.04 CONTRACTOR RESPONSIBILITIES

- A. Contractors shall provide the following documents **no less than seven (7) business days prior** to the start of contracted work:
 1. Scope of work to be performed
 2. Name of primary contractor’s on-site representative
 3. Names of all companies subcontracted to do work on the project
 4. Completed “Contract Firm Registration Form” (see attachment ‘A’) for prime contract firm and every subcontract firm
 5. A “Contractor Employee Registration Form” completed for the contractors and every employee who needs to be granted site access (see attachment ‘B’)
 6. List of items to be stored on-site
 7. Material Safety Data Sheets for all chemicals to be used/stored on-site
- B. Note: It is the responsibility of the prime contractor to facilitate gathering and submittal of the “Contractor Employee Registration Form” for all subcontractors working on the project. A subcontractor is defined as an individual or firm hired by the primary contractor to perform a specific task as part of the overall project. This would not include an organization making deliveries of supplies or equipment to the job site; procedures for these firms are covered under Part 8, "DELIVERIES".
- C. **In the event it is necessary for the prime contractor to add additional employees to the list of approved personnel, a minimum of 72 hours, or three (3) business days, must be allowed for processing of the request. Site access will be denied to the additional personnel until processing is complete.**
- D. Contract firms are obligated to notify MWW in a timely manner of any site-authorized staff that leaves the employ of the contractor.
- E. At no time should anyone but the prime contractor be contacting MWW employees with issues or access requests. If a request for site access does not come from the prime contractor, the request will not be processed.

- F. During the time period that the contractor is on-site, they must agree to:
1. Notify the plant manager immediately of any significant chemical spills or leaks.
 2. Maintain normal non-toxic breathable air quality, through adequate ventilation, at their work site.
 3. Perform no equipment isolations or tie-ins without the signed approval of site management.
 4. Restrict movement to the specific work areas within the site to perform contractor's scope of work.

2.05 CONTRACTOR SPECIAL WORK PERMITS

- A. Contractors must notify Engineering/site management staff of any welding, torching or potentially hazardous or operational impact request prior to commencing such operations. Special permits shall be issued to the contractor, and these must also be displayed at the work site.
- B. Failure to comply with the terms of the special work permits, or provisions that provide for MWW employee safety shall be cause for revocation of such permits, and the contractor may be forced to discontinue activities at the site.

2.06 CONTRACTOR IDENTIFICATION AND DAILY REGISTRATION

- A. Every day, all contractors shall be required to show a valid picture ID card, to sign-in at the start of work, and sign out at the end of work. A MWW employee or designated security representative shall be on site to ensure compliance. Any identification tags or lanyards issued by MWW are to be worn while on site and returned to site management upon completion of contracted work. A fee of \$50.00 will be charged for any identification tags or lanyards issued by MWW that are not returned.

2.07 CONTRACTOR GATE ACCESS AND PARKING

- A. Contractors must comply with the terms of entry for the site and park only in the areas designated for parking by the MWW site representative.
- B. Parking Note:
 1. Parking privileges may be rescinded at any time as site operational requirements dictate.

PART 3 - CITY OF MILWAUKEE PERMITS

3.01 GENERAL

- A. The contractor shall obtain the necessary permits for this project.

PART 4 - OCCUPANCY DURING CONSTRUCTION

4.01 GENERAL

- A. The MWW facility shall be in continuous operation during this contract. Contractor and subcontractors are to take any and all necessary precautions to ensure there is no interference with daily operations or security. MWW personnel shall be continuously occupying the facility. All hours of contractor's operations shall be coordinated with the MWW site or Water Engineering representative.

4.02 CONTRACTOR FIELD OFFICE/JOB TRAILER

- A. The prime contractor is responsible for providing their own field office via a construction job trailer, if required.

PART 5 - ELECTRICAL POWER AND TELEPHONE SERVICE

5.01 GENERAL

- A. On-site electrical service is available for contractor use during project duration within the Linnwood Water Plant. The contractor is required to request a dedicated service for any job trailers from the electric utility.
- B. Contractor shall provide and maintain all necessary power cords and electrical lighting, and shall make all necessary connections in accordance with OSHA regulations.
- C. Contractor shall provide, maintain and pay for his own wireless telephone and internet service.

PART 6 – HEAT AND VENTILATION

6.01 GENERAL

- A. Contractor shall provide and maintain all necessary heat and ventilation equipment required for the contract. Contractor shall perform all air treatment procedures and make all necessary connections in accordance with OSHA regulations.

PART 7 - WATER

7.01 GENERAL

- A. Water is available for the contractor at the site and may be obtained from the fixture(s) so designated by MWW staff or Water Engineering representative.
- B. Contractor and subcontractors must provide their own hoses, back flow preventer and any other connection appurtenances required for the contract.

PART 8 - TOILET FACILITIES

8.01 GENERAL

- A. On-site toilet facilities are available for contractor use during project duration. The specific location of these facilities will be transmitted to the contractor at the pre-construction meeting. However, if project requirements render the use of on-site facilities impractical, then contractor shall furnish portable facilities. If portable facilities are required, contractor shall maintain these toilet facilities in a sanitary condition throughout the duration of the project and shall remove them from site at the end of the project. The placement and location of the temporary portable toilets shall be coordinated with the plant manager and Water Engineering representative.

PART 9 - DELIVERIES

9.01 GENERAL

- A. Contractor shall coordinate the delivery of all equipment, material, dumpsters, portable toilets (and their maintenance) and other required items required for the contract work with the MWW staff. A minimum of 24 hours prior notice in advance of the desired delivery date shall be transmitted to the designated Water Engineering representative.
- B. Contractor shall provide the following information in the notification:
1. Trucking/Delivery Company
 2. Driver Name
 3. Truck License Plate Number
- C. The driver of the delivery vehicle is required to display picture identification as a prerequisite for entry to the MWW facility for the delivery. Failure to comply with the above will result in denial of project site access, requiring the contractor to reschedule delivery.

END OF SECTION

Milwaukee Water Works

Safe, Abundant Drinking Water.

FORM A

CONTRACT FIRM REGISTRATION FORM

CONTRACTOR: _____

PLANT/SITE: _____

CONTRACT/SERVICE ORDER No. _____

WATER ENGINEERING PROJECT No. _____

PRIMARY CONTACT PERSON: _____

OFFICE PHONE NUMBER: _____

CELL PHONE NUMBER: _____

REQUESTED WORK HOURS (00am – 00pm): _____

NUMBER OF EMPLOYEES TO BE WORKING ON-SITE: _____

**Signature certifies receipt of the materials outlined in
Contract Section 01500, Part 2 – Security and Safety, Section C, Policies.**

SIGNATURE: _____

DATE: _____

PRIMARY CONTACT PERSON

***Accompanying this form should be a complete listing of all
equipment to be stored on site for the duration of the project.***

Milwaukee Water Works

Safe, Abundant Drinking Water.

FORM B

CONTRACTOR EMPLOYEE REGISTRATION FORM

Contract Firm: _____

Plant/Site/Project: _____

Employee Name (Printed): _____

This certifies that I have received the building site security and safety policies.

EMPLOYEE
SIGNATURE: _____

Required

DATE: _____

ONSITE PARKING

- I will always be driving a Company vehicle.
- I will always be a passenger in a vehicle.
- I will be driving my personal vehicle. If checked here complete and sign the next section.

Contractor Personal Vehicle Liability Waiver

EMPLOYEE VEHICLE

MAKE & MODEL: _____ LICENSE PLATE: _____

I, hereby agree to hold harmless the City of Milwaukee for any and all damage, loss or injury, which may occur as a result of utilizing the contractor onsite parking area.

EMPLOYEE
SIGNATURE: _____

Required

DATE: _____

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 PRODUCTS

- A. Products: Defined as new material, machinery, components, equipment, fixtures and systems forming the work; does not include machinery and equipment used for preparation, fabrication, conveying and erection of the work.
- B. All materials which will be in direct contact with potable drinking water shall be in compliance with NSF Standard 61 Drinking Water System Components – Health Effects.
- C. Do not use materials and equipment removed from existing premises, except as specifically permitted.
- D. Assure standardization and uniformity in all parts of the work by providing like items of equipment or certain materials as products of one manufacturer.
- E. Uniformity in equipment items is required in order to provide the City of Milwaukee (City) with interchangeability capabilities, simplified spare parts inventories and standardized maintenance programs and manufacturers services.

1.02 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.03 STORAGE AND PROTECTION

- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.
- B. Provide off-site storage and protection when site does not permit on-site storage or protection.
- C. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- D. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- E. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.
- F. Spare parts and special tools shall be properly marked to identify the associated equipment by name, equipment and part number. Delivery of spare parts and special tools shall be made prior to the initial test run of the associated equipment.

END OF SECTION

SECTION 01640
EQUIPMENT MANUFACTURERS' SERVICES

PART 1 – GENERAL

1.01 DEFINITIONS

- A. Person-Day: One (1) person for eight (8) hours within regular contractor working hours.

1.02 SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, not less than fourteen (14) days prior to start-up of equipment (as applicable), and revise as necessary for acceptance.
2. Lesson Plan: Submit proposed lesson plan (as applicable), not less than fourteen (14 days) prior to scheduled training, and revise as necessary for acceptance.

1.03 QUALIFICATION OF MANUFACTURERS' REPRESENTATIVE(S)

- A. Authorized representative of the manufacturer, factory trained and experienced in the technical applications, installation, operation and maintenance of respective equipment, subsystem or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified elsewhere.
- B. Representative is subject to acceptance by City of Milwaukee (City). No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

- A. Furnish manufacturers' services when required by an individual specification section, to meet the requirements of this section.
- B. Where time is necessary in excess of that stated in the specifications for manufacturers' services, or when a minimum time is not specified, the time required to perform the specified services shall be considered incidental.
- C. Schedule manufacturers' services to avoid conflict with other on-site testing or other manufacturers' on-site services.
- D. Determine, before scheduling services, that all conditions necessary to allow successful testing have been met.
- E. Only those days of service approved by City will be credited to fulfill the specified minimum services.
- F. When specified in individual specification sections, manufacturer's on-site services shall include:

1. Assistance during product (system, subsystem or component) installation to include observation, guidance, instruction of contractor's assembly, erection, installation or application procedures.
2. Inspection, checking and adjustment as required for product (system, subsystem or component) to function as warranted by manufacturer and necessary to furnish manufacturer's certificate of proper installation.
3. Providing, on a daily basis, copies of all manufacturers' representatives' field notes and data to City.
4. Revisiting the site, as required, to correct problems until installation and operation are acceptable to City.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during functional and performance testing, and evaluation.
7. Training of City's personnel in the operation and maintenance of respective product(s) as required.
8. Additional requirements may be specified elsewhere.

3.02 MANUFACTURERS' CERTIFICATE OF COMPLIANCE

- A. When specified in an individual specification section, submit prior to shipment of product or material.
- B. City may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.
- C. Signed by product manufacturer certifying that product or material specified conforms to or exceeds specifications. Attach supporting reference data, affidavits and certifications as appropriate.
- D. May reflect recent or previous test results on material or product, if acceptable to City.

3.03 MANUFACTURERS' CERTIFICATE OF PROPER INSTALLATION

- A. When so specified, a manufacturers' certificate of proper installation shall be completed and signed by the equipment manufacturers' representative.
- B. Such certificate shall certify that the signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

3.04 TRAINING

- A. General:
 1. Furnish manufacturers' representatives for detailed classroom and hands-on training to City's personnel on operation and maintenance of specified product (system, subsystem and component) and as may be required in applicable specifications.

2. Furnish trained and articulate personnel to coordinate and expedite training, to be present during training coordination meetings with City and familiar with operation and maintenance manual information.
 3. Manufacturers' representative shall be familiar with facility operation and maintenance requirements, as well as with specified equipment.
 4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.
- B. Training Schedule: (as applicable)
1. List specified equipment and systems that require training services and show:
 - a) Respective manufacturer
 - b) Estimated dates for installation completion
 - c) Estimated training dates
 2. Allow for multiple sessions when several shifts are involved.
 3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by City, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
- C. Lesson Plan (as applicable): When manufacturer or vendor training of City personnel is specified, prepare for each required course, containing the following minimum information:
1. Title and objectives.
 2. Recommended types of attendees (e.g., managers, engineers, operators, maintenance, etc.).
 3. Course description and outline of course content.
 4. Format (e.g., lecture, self-study, demonstration, hands-on).
 5. Instruction materials and equipment requirements.
 6. Resumes of instructors providing the training.
- D. Pre-Start-up Training (as applicable):
1. Coordinate training sessions with City's operating personnel and manufacturers' representatives.
 2. Complete at least fourteen (14) days (if feasible) prior to beginning of facility startup.
- E. Post-Start-up Training (as applicable): If required in specifications, furnish and coordinate training of City's operating personnel by respective manufacturers' representatives.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Closeout Procedures
 - 2. Final Cleaning
 - 3. Adjusting
 - 4. Project Record Documents
 - 5. Operation and Maintenance Data
 - 6. Guarantee
 - 7. Spare Parts and Maintenance Materials
- B. Related Sections
 - 1. Section 01500 – Job Site Security, Utilities and Facilities

1.02 CLOSEOUT PROCEDURES

- A. Submit written certification that contract has been reviewed, work has been inspected, and work is complete in accordance with contract and is ready for City of Milwaukee (City) inspection.
- B. Provide submittals to City that is required by governing or other authorities.
- C. Submit final application for payment identifying total adjusted contract price, previous payments, and sum remaining due.

1.03 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean equipment and fixtures to a sanitary condition.
- C. Clean site, sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste and surplus materials, rubbish, and construction facilities from the work site.

1.04 ADJUSTING

- A. Adjusting operating products and equipment to ensure smooth and unhindered operation.

1.05 PROJECT RECORD DOCUMENTS

- A. Maintain on-site, one (1) set of the following record documents; record actual revisions to the work:

1. Contract Drawings
 2. Specifications
 3. Addenda
 4. Change Orders
 5. Reviewed Shop Drawings, Product Data, and Samples
 6. Permits issued (as applicable).
- B. Store record documents separate from documents used for construction.
- C. Record information concurrent with construction progress. Electrical boxes and conduit location determined in the field and not specifically shown on the drawings shall be recorded and documented.
- D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number
 2. Product substitutions or alternate utilized
 3. Changes made by addenda or change orders
- E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
 2. Field changes of dimensions and details.
 3. Details not on original contract drawings.
- F. Delete consultant, City title block and engineer's seal from all documents.
- G. Submit **five (5)** sets of documents with **one (1)** reproducible copy to City prior to final application for payment.
1. Accompany submittal with transmittal letter containing the following:
 - a) Date
 - b) Project title and number
 - c) Contractor's name and address
 - d) Title and number of each record document
 - e) Certification that each document as submitted is complete and accurate
 - f) Signature of contractor, or his authorized representative

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit **six (6)** sets prior to final inspection, bound in 8 ½ x 11 -inch text pages, three D-side ring binder capacity expansion binders with durable plastic covers.
- B. Prepare binder covers with printed title "OPERATION MAINTENANCE INSTRUCTIONS", title of project, and subject of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a table of contents for each volume, with each product or system description identified, typed on 30-pound white paper.
 - 1. Part 1: Directory, listing names, addresses, telephone numbers and emails of City, contractor, subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify name, addresses, telephone numbers and emails of subcontractors and suppliers.
Identify the following:
 - a) Significant design criteria
 - b) List of equipment
 - c) Parts list for each component
 - d) Operating instructions
 - e) Maintenance instructions for equipment and systems
 - f) Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents
 - 3. Part 3: Project documents and certificates, including the following:
 - a) Shop drawings and product data
 - b) Air and water balance reports
 - c) Certificates
 - d) Photocopies or warranties and bonds, if required
- E. Special Requirements for Operation and Maintenance Data and Manuals: Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The contractor shall provide operation and maintenance manuals for each type of equipment supplied.

1. Operation and maintenance manuals shall include the following:
 - a) All sets of manuals shall be originals. Copies will not be acceptable.
 - b) Equipment function, normal operating characteristics, and limiting conditions.
 - c) Assembly, installation, alignment, adjustment, and checking instructions.
 - d) Operation instructions for start up, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 - e) Lubrication and maintenance instructions, including lubrication cross references to a minimum of three locally available suppliers.
 - f) Guide to "troubleshooting".
 - g) Parts list and predicted life of parts subject to wear.
 - h) Outline, cross-section, and detailed assembly drawings; engineering data; wiring diagrams.
 2. The operation and maintenance manuals shall be in addition to any instructions or parts packed with or attached to the equipment when delivered, or instructions that may be required by the contractor.
 3. Manuals and other data shall be printed on heavy, first quality paper, in an 8 ½ x 11-inch size with standard 3-hole punching. Drawings and diagrams shall be reduced to 8 ½ x 11-inches, or 11 x 17 inches. Where reduction is not practicable, larger drawings shall be folded separately and placed in an envelope that is bound into the manuals. Each envelope shall bear suitable identification on the outside.
 4. Material shall be assembled and bound in the same order as it appears in the specifications, and each volume shall have a table of contents and suitable index tabs.
 5. All submittals shall be marked with contract identification, and inapplicable information shall be erased or deleted.
 6. Shipment of equipment will not be considered complete until required data and manuals have been received.
- F. Copies will be returned after final inspection, with City's comments. Revise content of documents as required prior to final submittal.
- G. Submit final volumes within **ten (10)** days after receipt of City's comments.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts and equipment, maintenance and extra materials in quantities as noted in applicable specification sections.
- B. Deliver to project site and place in location as directed, obtain receipt prior to final payment.

1.08 GUARANTEE

- A. Provide duplicate notarized copies.
- B. Execute and assemble documents and subcontractors, suppliers, and manufacturers.
- C. Provide table of contents and assemble in three D-side ring binder with durable plastic cover.
- D. Submit prior to final application for payment.

END OF SECTION

SECTION 02050
DEMOLITION

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers the demolition of portions of existing structures, piping, equipment, and site work as indicated on the drawings.

1.02 GENERAL

- A. The contractor shall be responsible for all work under this section.
- B. All structures and facilities of the Linnwood plant which are not to be removed must remain in continuous operation during the work. Demolition and salvage work shall create minimum interference with the water plant operations and minimum inconvenience to the City of Milwaukee (City).
- C. Any structural member that provides support, restraint, stabilization, etc., for any part of the water plant facilities shall remain in place, if possible, during demolition. If the member must be moved or demolished, adequate measures shall be taken to provide support, restraint, etc., for all affected parts of the Linwood plant facility.
- D. Blasting will not be permitted.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DEMOLITION

A. General

1. All portions of existing structures, piping, equipment, and site work indicated on the drawings to be demolished shall be removed and shall become property of the contractor, unless otherwise specified. All such items shall be promptly removed from the job site.
2. All piping and equipment remaining after demolition that will not be incorporated in the new work shall be permanently capped in a manner acceptable to City.
3. All pavements, including curb and gutter, shown to be removed shall have a neat sawcut edge and shall be removed full depth, to include aggregate base.
4. The cutting and removal of pavement shall be performed by equipment and methods which will leave a vertical uniform face on the remaining pavement.
5. Any irregularities shall be eliminated by bush hammering or grinding to the satisfaction of the City representative.

6. Contractor shall take all precautions necessary when removing concrete pipe encasement to expose existing steel pipe that is to be removed and modified per the drawings.

3.02 ABANDONMENT

A. General

1. Service shall be maintained until the City, or an authorized City representative, shall order sewers, storm drains, and sewer structures that are no longer in use to be bulkheaded and abandoned.
2. The cost of abandoning sewers, storm water drains, and sewer structures is incidental to construction.

3.03 RESTORATION

A. General

1. All structures and surfaces damaged during the course of demolition work that are to remain in the completed work, shall be restored by the contractor as follows:
 - a) All restoration work shall be done with new materials and appropriate methods as specified elsewhere in these specifications for new work of similar nature; or, if not specified, best recommended practice of manufacturer, or appropriate trade association.
 - b) Damaged work shall be restored in such a way that there is a secure bond or fastening between new and old work. Restored surfaces shall be finished to such planes, shapes, and textures that no transition between new and old work is pronounced in finished surfaces.
2. All holes remaining in existing concrete structures which were part of the demolition work shall be patched with concrete and/or non-shrink grout. The patch shall be structurally keyed and bonded/anchored to the existing concrete structure. Holes in existing buried and/or water holding structures shall be repaired with a patch which is also watertight.
3. All holes remaining in existing masonry structures which were created by demolition work shall be patched with non-shrink grout if smaller than 9 square inches and shall be repaired to match adjacent construction if larger than 9 square inches.
4. All exposed anchor bolts, reinforcement, and other metal items remaining in existing concrete structures shall be cut, and then patched with nonmetallic, non-shrink grout. The concrete around each item shall be chipped back a minimum of one inch, then water saturated for 24 hours prior to cutting the item. Immediately after cutting the item, coat it with an epoxy bonding agent and patch the hole.

3.04 SALVAGE MATERIALS

- A. During demolition procedures the contractor shall allow the City to request the salvage of materials and shall return those materials to the possession of the City.

END OF SECTION

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers earthwork and shall include the necessary preparation of the site for the work; removal and disposal of all debris; excavation; handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection of the work; preparation of sub-grades; pumping and dewatering as necessary; protection of adjacent property; backfilling; surfacing and grading; and other appurtenant work.

1.02 GENERAL

- A. With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, Contractor shall employ a competent person and, when necessary based on the regulations, a registered professional engineer, to act upon all pertinent matters of the work of this section.

1.03 SUBMITTALS

- A. Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the requirements of Section 01010 and this section.
- B. Sheeting, shoring (as required), and excavation support systems' submittals shall bear the seal and signature of a Professional Engineer licensed or registered in the State of Wisconsin.
- C. Filter Fabric Data
1. Complete descriptive and engineering data for the fabric shall be submitted in accordance with the Submittals section. Data submitted shall include:
 - a) 12-inch square sample of fabric
 - b) Manufacturer's descriptive product data
 - c) Installation instructions
- D. Erosion Control Implementation Plan

1.04 INSURANCE

- A. Professional Liability insurance shall be provided.
1. Professional liability insurance shall be required for any sheeting, shoring, and excavation support systems design services, as specified herein, to be performed by a professional engineer with appropriate expertise in accordance with applicable laws and regulations, licensed or registered in the State of Wisconsin, where the shop drawings or other evidence of design bear the seal and signature of that professional engineer.

This insurance shall provide protection against claims arising out of performance of professional design services and caused by a negligent error, omission, or act for which the insured party is legally liable; such professional liability insurance shall provide coverage in the amount of \$3,000,000 which shall be maintained throughout the duration of the Project and for one year after Final Acceptance.

2. In the event that the professional design services are performed by an independent consultant or Subcontractor engaged by Contractor, this insurance shall be furnished and maintained by the independent consultant or Subcontractor. In the event that the professional design services are performed by a member of Contractor's organization, this insurance shall be furnished and maintained by Contractor.
3. A certificate of insurance for such professional liability insurance coverage, including the amount, duration, and name of the insured party, shall be delivered to City.

1.05 EROSION CONTROL IMPLEMENTATION PLAN (ECIP)

A. General

1. Within fifteen (15) days after Notice to Proceed is issued, and at least twenty (20) working days prior to the start of any construction activity, the Contractor shall submit to the City for review & approval a minimum of three copies of an Erosion Control Implementation Plan (ECIP). The Contractor shall allow two (2) weeks for the City to review the ECIP for meeting technical standards and for the City to notify the Contractor if the plan meets the standards.
2. Work shall not start until the ECIP meets technical standards. No construction activity may begin without an ECIP approved by the City.
3. The Contractor shall be required to have a copy of the ECIP on the job site for the entire duration of the Contract.
4. The ECIP shall include, but not be limited to:
 - a) A completed "Erosion Control Implementation Plan" application (See Attachment "H").
 - b) A plan showing all locations of erosion control devices and other Best Management Practices (BMP's).
 - c) A written description of all erosion control devices and BMP's to be used.
 - d) A written schedule of installing erosion control devices.
 - e) A written schedule of construction operations related to implementing erosion control devices and BMP's.
 - f) A written maintenance schedule for all erosion control devices and BMP's.

5. All costs associated with implementing the erosion control plan, such as furnishing, installing, maintaining, and removal of erosion control devices shall be included in the lump sum bid for the project. There shall be no additional compensation for revising the ECIP or utilizing additional BMP's in order to comply with Chapter 290 of the City of Milwaukee Code of Ordinances. If the Contractor is found not in compliance with the ECIP, the Contractor will be subject to the penalties included in Chapter 290.

B. Erosion Control Site Plan Characteristics

1. The Contractor may utilize the Contract Drawings for this project or provide a separate site diagram. The following information shall be included on the ECIP:
 - a) The scale of the drawing (not less than 1" = 100')
 - b) A north arrow (towards the top or to the right of the plan)
 - c) The name of all project streets and streets abutting the project
 - d) Approximate location of all existing and proposed drainage structures
 - e) The direction of water runoff (flow arrows)
 - f) The proposed limits of construction
 - g) The approximate location of all erosion control devices
 - h) Areas where vegetation will be disturbed and re-established
 - i) For non right-of-way projects, locate watershed areas of overland and concentrated flow. Include area sizes in acres and representative soil type of disturbed areas.

C. Storm Water Inlet Protection

1. Any structure that is connected to the drainage system shall be protected from sediment entering the system.
2. All storm water inlets adjacent to and on the project site shall have type M inlet protection.
3. If the frame of any storm water inlet or manhole is removed, or openings are in the masonry where storm water may enter, the protection device should be changed to a type R.

D. Temporary storage piles.

1. Storage of erodible materials (e.g. gravel, soil, etc.) should not be closer than 25 feet of a roadway or drainage way.
2. If placed in the right-of-way, the stockpiles shall not be placed closer than 100 feet of an unprotected storm drain.

3. Covering or surrounding with straw bales, silt fence or other measures, shall control erosion from stockpiles existing less than ten (10) days.
 4. Stockpiles existing longer than ten (10) days shall be seeded and mulched.
- E. Tracking
1. The project and surrounding roadways shall be kept free from materials that may enter the drainage system.
 2. Tracking pads at ingress and egress points may be used to help control tracking of sediment onto roadway surfaces. The pads shall be constructed with a minimum 3-inch size stone, a minimum of 8-feet wide and a minimum of 50-feet long.
 3. Tracked roadways shall be cleaned immediately by means other than flushing with water.
 4. The project roadways shall be cleaned on a daily basis. Cleaning shall be done by means other than flushing with water.
- F. Locating Sediment Controls
1. Current Wisconsin Department of Natural Resource publications shall be consulted to determine the location of sediment controls (e.g. silt fence, straw bales, stone tracking pads, etc.) that minimize the amount of sediment from leaving the site.
 - a) Storm Water Management Technical Standards
 - b) The “*Wisconsin Construction Site Best Management Practices Handbook*”
- G. Dewatering
1. Water containing particles of 100 microns or greater shall be treated by use of temporary sediment basins or other devices designed to remove particles of 100 microns or greater.
- H. Vegetation
1. The construction activity shall be staged as to limit the amount of time vegetation is stripped and re-established.
 2. Contractor shall utilize road plates to protect areas of greenspace and vegetation from ruts or depressions caused by construction traffic.
 3. Refer to Section 02200 Earthwork and Section 02930 Seeding, as well as any applicable construction plan sheets, for further instruction on vegetation disturbance, protection, and restoration.
- I. Maintenance
1. A schedule for maintaining all erosion control devices is necessary to maximize the effort of limiting sediment from entering the drainage system.

2. All devices shall be inspected and maintained after a rainfall event that totals 0.50 inches.
3. All devices shall be inspected and maintained at least once a week.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Filter Fabric

1. Filter Fabric shall be provided in rolls wrapped with covering for protection from mud, dirt, dust and debris.
 - a) Filter Fabric Type FF shall be provided for installation at locations indicated on the drawings. Filter fabric Type FF shall be a woven polypropylene fabric and shall have the indicated properties:

Grab Tensile Strength, lb.	ASTM D-4632	200 min.
Puncture Strength, lb.	ASTM D-4833	105 min.
Apparent Breaking Elongation Machine Direction, %	ASTM D-4632	24 min.
Apparent Breaking Elongation, Cross Direction, %	ASTM D-4632	10 min.
Apparent Opening Size, μm	ASTM D-4754	600 max.
Permittivity, s-1	ASTM D-4491	1.9 min.

B. Polyethylene film

1. Polyethylene film beneath concrete slabs or slab base course material shall be Product Standard PS17, 6 mil minimum thickness.

C. General Fill and Embankment Materials

1. To the maximum extent available, excess suitable material obtained from structure and trench excavation shall be used for the construction of general fills and embankments. Additional material shall be provided from Contractor's offsite source. No borrow pits shall be opened on site unless such pits are specifically indicated on the drawings.
2. All material placed in fills and embankments shall be free from rocks or stones larger than the required size in their greatest dimension, brush, stumps, logs, roots, debris, and other organic or deleterious materials. The maximum size of stone in fills and embankment shall be 4 inches. No rocks or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so that they do not interfere with proper compaction.

D. Select Granular Fill

- Granular fill material shall be crushed rock or gravel suitable for use as a free draining sub-base beneath slabs and foundations. Granular fill shall be free from dust, clay, and trash; hard, durable, non-friable; and shall be graded 3/4 inch to No. 4 as defined in ASTM C33 for No. 67 coarse aggregate and indicated below. Granular fill shall meet the quality requirements for ASTM C33 coarse aggregate. Only crushed rock with angular particles shall be used when the perimeter of the granular fill is not confined or otherwise subject to raveling, such as on a slope.

<u>Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	90 - 100
3/8 inch	20 – 55
No. 4	0 - 10
No. 8	0 – 5

E. Dense Graded Base

- Dense graded base (3/4-inch) shall be placed as a sub-base for asphaltic concrete pavement and beneath concrete curb & gutter. Dense graded base (3/4-inch) shall meet the following Wisconsin Department of Transportation Gradation requirements:

<u>Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	95 - 100
3/8 inch	50 - 90
No. 4	35 - 70
No. 10	15 - 55
No. 40	10 – 35
No. 200	5.0 – 15.0 *

* 8.0 – 15.0 if base is _ 50 percent crushed gravel.

2.02 MATERIAL TESTING

A. Preliminary Review of Materials

1. As stipulated in the Quality Control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of Contractor. Two initial gradation tests shall be made for each type of general fill, designated fill, backfill, or other material, and one additional gradation test shall be made for each additional 500 tons of each material delivered to the jobsite. In addition, one set of initial Atterberg Limits tests shall be made for each fill material containing more than 20 percent by weight passing the No. 200 sieve and for materials specified by Atterberg Limits. One additional Atterberg Limits test shall be made for each additional 500 tons of each material delivered to the job site.

B. Field Testing Expense

1. All moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory approved by the City at the expense of Contractor. Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples.

C. Required Field Tests

1. For planning purposes the following guidelines shall be used for frequency of field tests. Additional tests shall be performed as necessary for job conditions and number of failed tests. Test results shall be submitted as indicated in the Submittals section.
 - a) Two moisture-density (standard Proctor) tests in accordance with ASTM D698 or two relative density tests in accordance with ASTM D4253 and D4254 for each type of general fill, designated fill, backfill, or other material proposed.
 - b) For area fills and embankments, an in-place field density and moisture test for each 1000 cubic yards of material placed.
 - c) One in-place field density and moisture test for every 100 to 200 cubic yards of structure backfill or select fill.
 - d) One in-place density and moisture test whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.
 - e) At least one test for every full shift of compaction operations on mass earthwork.
 - f) Additional gradation, proctor, and relative density tests whenever the source or quality of materials changes.

PART 3 - EXECUTION

3.01 SITE PREPARATION

- A. All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments and sites to be occupied by permanent construction shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of Contractor.

3.02 EXCAVATION

A. General

1. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.
2. Sub-grade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon. Do not place base on foundations that are soft, spongy, or covered by ice or snow. Water and rework or recompact dry foundations as necessary to ensure proper compaction, or as the City directs.
3. Except where exterior surfaces are specified to be damp-proofed, monolithic concrete manholes and other concrete structures or parts thereof that do not have footings that extend beyond the outside face of exterior walls may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.
4. Excavations for manholes and similar structures constructed of masonry units shall have such horizontal dimensions that not less than 6 inches clearance is provided for outside plastering.

B. Classification of Excavated Materials

1. No classification of excavated materials will be made for payment purposes. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

C. Unauthorized Excavation

1. Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced with concrete at the expense of Contractor. It shall be placed at the same time and monolithic with the concrete foundation.

D. Blasting

1. Blasting or other use of explosives for excavation will not be permitted.

E. Dewatering

1. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
2. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level to the minimum depth of 24 inches beneath such excavations. The specified dewatering depth shall be maintained below the prevailing bottom of excavation at all times.
3. Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.
4. Contractor shall be responsible for the condition of any pipe or conduit used for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

F. Sheet piling and Shoring

1. Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported as necessary to prevent caving or sliding.
2. Steel sheet piling or other excavation support systems shall be furnished and installed as necessary to limit the extent of excavations for the deeper structures and necessary backfill under adjacent shallower structures, and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. Contractor shall assume complete responsibility for, and install adequate protection systems for prevention of damage to existing facilities.

3. Excavation support systems and sheeting and shoring shall be all removed after completion of work.
4. The design of the excavation support system shall be such as to permit complete removal while maintaining safety and stability in the excavation at all times.
5. Sheeting, shoring and excavation support systems shall be designed by a professional engineer retained by the Contractor and registered in the state where the project is located.

G. Stabilization

1. Sub-grades for concrete structures shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.
2. Sub-grades for concrete structures which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel as specified for granular fills. The stabilizing material shall be placed in such a manner that no voids remain in the granular fill. All excess granular fill with unfilled void space shall be removed. The finished elevation of stabilized sub-grades shall not be above sub-grade elevations indicated on the drawings.

I. Roadway Excavation

1. Excavation for the roadways, drives, and parking areas shall conform to the lines, grades, cross sections, and dimensions indicated on the drawings and shall include the excavation of all unsuitable material from the subgrade. After shaping to line, grade, and cross section, the subgrade shall be compacted to a depth of at least 6 inches and shall meet the following:

Test method to determine
maximum density and moisture: ASTM D698

Relative compaction and moisture content
relative to the optimum: 95%

Moisture content
relative to the optimum: -2% to +2%

2. This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft, yielding, or otherwise unsuitable material shall be removed and replaced with suitable material.

3.03 GENERAL FILLS AND EMBANKMENTS

A. General

1. Fills and embankments not required or indicated to be designated fills shall be constructed as general fills and embankments. All fills and embankments shall be constructed to the lines and grades indicated on the drawings. Backfill materials shall be deposited in layers not to exceed 8 inches in uncompacted thickness. Unless otherwise specified herein, the following governing standards apply:

Test method to determine
maximum density and moisture: ASTM D698

Relative compaction and moisture content
relative to the optimum: 95%

Moisture content
relative to the optimum: -2% to +2%

2. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of City. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

B. Sub-grade Preparation

1. After preparation of the fill or embankment site, the sub-grade shall be scarified and moisture conditioned to a minimum depth of 8 inches, leveled and rolled so that surface materials of the sub-grade will be at a moisture content and as compact and well bonded with the first layer of the fill or embankment as specified for subsequent layers.
2. Unless otherwise directed by City, the sub-grade shall be proof-rolled by a rubber-tired roller, a loaded dump truck, or other suitable rubber-tired equipment acceptable to City. A minimum of four passes of the proof-rolling equipment shall be provided such that the last two passes are made perpendicular to the first two passes.
3. All soft, yielding, or otherwise unsuitable material shall be removed and replaced with compacted fill.

C. Placement and Compaction

1. All fill and embankment materials shall be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.

2. Each layer of material shall have the best practicable moisture content for satisfactory compaction. The material in each layer shall be wetted or dried to achieve the moisture content relative to optimum as specified above, and shall be thoroughly mixed to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted to the required degree of compaction at the required moisture content. If the material fails to meet the density specified, compaction methods shall be altered. The changes in compaction methods shall include, but not be limited to, changes in compaction equipment, reduction in uncompacted lift thickness, increase in number of passes, and better moisture control.
3. Wherever a trench is to pass through a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation not less than 12 inches above the top of pipe elevation before the trench is excavated.

D. Borrow Pits

1. Borrow pits are not permitted

3.04 DESIGNATED FILLS

A. General

1. Fills required or indicated to be designated fills shall be constructed using the specific materials and placement requirements as specified. In addition to the specific requirements specified herein, all requirements for general fills and embankments shall apply. These requirements include, but are not limited to organic or deleterious materials, subgrade preparation, lift thickness, and moisture conditioning requirements. All designated fills shall be constructed to the lines and grades indicated on the drawings. Backfilling and construction of fills during freezing weather shall not be done except by permission of City. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

B. Select Granular Fill

1. Granular fills shall be provided where indicated on the drawings. Granular fills shall be placed on suitably prepared sub-grades in uncompacted lift thickness of 6 inches or less and shall meet the following requirements:

Test method to determine maximum density and moisture:	ASTM D698
Relative compaction and moisture content relative to the optimum:	95%
Moisture content relative to the optimum:	-2% to +2%

2. Where granular fills are to be covered with concrete, the top surface shall be graded to the required sub-grade elevation. The completed fill shall be covered by a vapor barrier.
- C. Dense Graded Base
1. The dense graded base beneath the asphaltic concrete pavement shall be placed in lift thicknesses not to exceed a compacted thickness of 6 inches per layer if using a pneumatic roller, or 8 inches if using a vibratory roller
- 3.05 FINAL GRADING AND PLACEMENT OF TOPSOIL
- A. After other outside work has been finished, and backfilling and embankments completed and settled, all areas that are to be graded shall be brought to grade at the indicated elevations, slopes, and contours. All cuts, fills, embankments, and other areas that have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of 4 inches. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, and debris, and well suited to support plant growth.
 - B. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to manual methods. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.
 - C. Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris.
- 3.06 DISPOSAL OF EXCAVATED MATERIALS
- A. Suitable excavated materials may be used in fills and embankments as needed. All excess excavated material shall be disposed of offsite at the expense of Contractor.
 - B. All debris, stones, logs, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by, and at the expense of, Contractor.
- 3.07 RESTORATION
- A. All established lawn or green-space areas cut by the line of trench, by excavation, or damaged during the work shall be restored and seeded, after completion of construction, to the complete satisfaction of the City. Refer to section 02930.
- 3.08 SETTLEMENT
- A. Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period stipulated in the General Conditions.
 - B. Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from City.

END OF SECTION

ATTACHMENT "H"

CITY OF MILWAUKEE

DEPARTMENT OF PUBLIC WORKS

Erosion Control Implementation Plan

The Erosion Control Implementation Plan (ECIP) is an effort to conform to Chapter 290 of the Code of Ordinances. The ECIP shall be submitted to the City Engineer at least ten (10) working days prior to the start of any construction activity. **NO** construction activity may begin without an ECIP approved by the Department of Public Works.

<i>FOR OFFICE USE ONLY</i>				Application No. _____	
Meets Technical Standards <input type="checkbox"/>		Does Not Meet Technical Standards <input type="checkbox"/>			
Date Application Received: _____		Date all Information Received: _____		Reviewed By: _____	
Fee Paid <input type="checkbox"/>		Check No. : _____			
		APPLICANT (Contractor)		Erosion Control Consultant/Engineer	
Name					
Address					
City/State/Zip					
Phone		()		()	
Relationship to Project					
Principal Contact Responsible for Installation, Maintenance and removal of erosion control measures :					
Name					
Phone		()		Fax ()	
Type of Construction					
Proposed Construction Start Date					
Any public waterway within 1,000 feet of any location.		Yes <input type="checkbox"/>		No <input type="checkbox"/>	

ECIP REQUIREMENTS:

- Attach a description of erosion control devices and other best management practices to be utilized on the project(s). The description should include, but not be limited to: type of products; i.e., *Geotex Fabric*, Manufacturer's Names and Types of Equipment (i.e.; self-contained power broom)
- Attach the intended timetable and sequence of construction activities.
- Attach the intended timetable and sequence of best management practices and devices to be implemented for erosion control.
- Attach a site plan showing approximate locations(s) of erosion control devices. The site plan shall be at a scale of no less than 1" = 100'. The plan shall also indicate the direction of runoff flow, the construction limits, temporary stockpiles and any other significant information.

Upon receipt of all required information, the ECIP will be reviewed within ten (10) working days and all involved parties will be notified whether or not the plan meets technical standards.

Applicant's Signature: _____ **Date:** _____

SECTION 02612**PRESTRESSED CONCRETE CYLINDER PIPE (PCCP)****PART 1 - GENERAL****1.01 DESCRIPTION OF WORK**

- A. Supply and installation of 120" and 72" diameter PCCP pipe, fittings, and closure pieces required to accommodate the installation of a new 72" diameter, direct bury butterfly valve (BFV) designated as Valve #3 on the drawings.
- B. Supply and installation of 90" and 72" diameter PCCP pipe, fittings, and closure pieces required to accommodate the installation of a new 72" diameter direct bury BFV designated as Valve #4 on the drawings.
- C. Supply and installation of 78" and 72" diameter PCCP pipe, fittings, and closure pieces required to accommodate the installation of a new 72" diameter direct bury BFV designated as Valve #5 on the drawings.

1.02 QUALITY CONTROL

- A. Finished pipe shall be the product of one (1) manufacturer who has no less than ten (10) years successful experience manufacturing pipe of the types and sizes indicated.
- B. The City may require the manufacturer to furnish mill test certificates on reinforcing steel or wire, steel plate, and cement. The manufacturer shall perform the tests described in AWWA C301, for all pipe, fittings and specials.

Standards applicable to work specified herein are, but not limited to, the following:

1. AWWA C301 – Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
2. AWWA C304 – Design of Prestressed Concrete Cylinder Pipe
3. AWWA C651 – Disinfection of Watermains
4. AWWA Manual M9 – Concrete Pressure Pipe
5. American Association of State Highway and Transportation Officials (AASHTO)

Where reference is made to one of the above standards, the revision in effect at the time shall apply.

1.03 SUBMITTALS

- A. All submittals of drawings and data shall be in accordance with the requirements of Section 01010 and this section.
- B. The required submittals shall include drawings, design calculations, specifications, piping and valve layouts and execution drawings. **NO PIPE, FITTINGS, OR SPECIALS SHALL BE MANUFACTURED UNTIL ALL SUBMITTALS HAVE BEEN APPROVED BY THE CITY.**
- C. Prior to the fabrication of the pipe, submit fabrication and laying drawings to the engineer for record purposes. Record drawings shall include a complete description of the pipe offered, including cuts, tabulated layout and pertinent design data. Record drawings shall reference stationing on the plan profile sheets and shall incorporate changes necessary to avoid conflicts with existing utilities and structures. Details for the design and fabrication of all fittings and specials and provisions for thrust shall be included.
- D. Prior to delivery of the pipe to the project site, the manufacturer shall furnish an affidavit certifying that all pipe, fittings and specials and other products and materials furnished, comply with this specification. Copies of results of factory tests and mill certificates for steel and cement shall be provided, if requested.

PART 2 – PRODUCTS

2.01 PCCP PIPING AND FITTINGS

- A. Prestressed Concrete Embedded Cylinder Pipe shall be designed and manufactured in accordance with the applicable provisions of AWWA C304 and C301, latest revision, respectively. The manufacturing facility shall be certified under the American Concrete Pressure Pipe Association audit and certification program.
- B. Cement shall be Type I or Type II and shall be in accordance with ASTM C150.
- C. The pipe core shall be manufactured by the centrifugal or vertically cast process.
- D. Mortar coatings shall consist of one part cement to a maximum of three parts fine aggregate, by weight. Rebound, not to exceed one-fourth of the total mix weight, may be used provided the rebound is treated as fine aggregate.

- E. Bell and spigot joint rings shall be steel, self-centering type and otherwise as specified in AWWA C301.
- F. The rubber gaskets shall be in accordance with AWWA C301.
- G. Bell and spigot wall fittings shall be equal as manufactured by Hanson Pressure Pipe. Wall fittings shall be supplied with adequate bracing to keep them round and true during transportation and construction.
- H. Restrained joints, installed as indicated on the drawings or as directed by the engineer, shall be the clamp type; snap ring or welded joint type as shown in AWWA Manual M9.
- I. Radii for curved sections as specified on the drawings may be produced by joint deflection as recommended by the pipe manufacturer. Deflections required which are in excess of those recommendations shall be produced by beveling the end of the pipe.
- J. Bends shall be fabricated to the deflection angle required.
- K. Steel thickness of all fittings shall be designed in accordance with AWWA Manual M9 and AWWA C301 specifications.
- L. Interior and exterior concrete/mortar coating shall be as per AWWA C301.

2.02 SHIPPING, STORAGE AND HANDLING

- A. Properly support and secure pipe for storage. The pipe manufacturer shall obtain the necessary transportation permits. Upon delivery of the pipe, notify the engineer so that an inspection may be performed. The inspection shall not relieve the contractor's responsibility of providing pipe which meets the contract requirements. Other handling and storage requirements shall be in accordance with the manufacturer's recommendations.
- B. The date of manufacture or a serial number traceable to the date of manufacture and the mark or trademark of the manufacturer shall be clearly marked by stencil with waterproof paint at the ball end of the pipe barrel. Unsatisfactory or damaged pipe will be either permanently rejected or returned for minor repairs. Pits, blisters, rough spots, minor breakage and other imperfections may be repaired, subject to the approval of the engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 3,000 psi (20.7 MPa) at the end of 7 days and 4,500 psi (31 MPa) at the end of 28 days, when tested in cylinders stored in the standard manner. Major breakage or spalling from interior of pipe shall be reason for the rejection of pipe.
- C. The above supplements Section 01600, Materials and Equipment.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Prestressed concrete embedded cylinder pipe and fittings shall be installed in accordance with requirements of AWWA Manual M9, Concrete Pressure Pipe, except as otherwise provided herein.
- B. All prestressed concrete cylinder pipe shall have a minimum of 3' (0.9m) of cover or as shown on the drawings, whichever is greater. Pipe shall be laid such that the invert elevations shown on the drawings are not exceeded.
- C. The pipe interior shall be maintained dry and broom clean throughout the construction period.
- D. Gasket, gasket groove and bell shall be cleaned and lubricated with a vegetable lubricant furnished by the pipe manufacturer. The lubricant shall be approved for use in potable water and shall be harmless to the rubber gasket. Pipe shall be laid to match existing pipe. As soon as the spigot is centered in the bell of the previously laid pipe, it shall be forced home with approved automatic equipment. After the gasket is compressed, verify the position of the gasket with a feeler gauge provided by the pipe manufacturer.
- E. Place a cloth diaper approved by the pipe manufacturer around each exterior joint recess and fasten it in place with either wire or steel strapping stitched into its edges. Mix a 1:3 mortar grout of sufficient liquid consistency to flow easily and pour it into the joint recess beneath the cloth band. To assist the flow and to assure complete filling of the entire recess completely around the pipe, fill the joint with mortar from one side in one continuous operation until the grout has flowed entirely around the pipe. During the filling of the joint, pat or manipulate the sides of the wrapper to settle the mortar and expel any entrapped air. Close the joint recess at the top with a stiffer mix of the same mortar.
- F. Where applicable, pack interior joints of pipe 30" (750mm) diameter and larger with mortar after backfilling is completed. Mortar grout shall be employed, consisting of one part by volume of Portland cement, three parts by volume of well graded coarse concrete sand meeting the requirements of ASTM C33, and sufficient water to make a stiff mortar suitable for overhead work. The mixture shall have a dry, crumbly consistency and shall be pushed into place and troweled to make a smooth joint.
- G. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflections at joints shall be as recommended by the manufacturer. Fittings, in addition to those shown on the drawings, shall be provided, if required, in crossing

utilities which may be encountered upon opening the trench or any other situation encountered that requires horizontal or vertical alignment adjustments.

- H. Have on hand a sufficient supply of assorted short pipe lengths, adapters and any other fittings necessary to prevent delays in pipe laying.
- I. Provide mechanical or welded joint restraint per AWWA Manual M9.
- J. Bolts, flange faces and steel joint rings shall be shop coated with rust preventative compound. All other metal surfaces shall be shop primed in accordance with the manufacturer's recommendations.

3.02 HYDROSTATIC AND LEAKAGE TESTS

- A. Furnish all necessary equipment and labor for conducting a hydrostatic pressure test on the pipelines. The procedures and method for conducting the pressure tests shall be approved by the engineer.
- B. Make any taps and furnish all necessary caps, plugs, bulkheads, etc., as required in conjunction with testing portions of the pipe. Furnish test pumps, gauges, meters and any other equipment required in conjunction with carrying out the tests. Hydrostatic pressure and leakage tests shall conform with AWWA Manual M9.
- C. All pipelines shall be subjected to a hydrostatic pressure of 20% above the normal operating pressure (40psi) at the lowest point of the section being tested and this pressure maintained for at least one hour. The amount of leakage which will be permitted shall be in accordance with AWWA Manual M9.
- D. Lines which fail to meet the requirements of the test shall be repaired and retested as necessary until test requirements are met. Defective materials, pipe, valves and accessories shall be removed and replaced.

3.03 CLEANING

- A. At the conclusion of the work, thoroughly clean all of the new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed.
- B. After the pipelines are cleaned and if the ground water level is above the pipe, or following a heavy rain, the engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired or replaced.

3.04 DISINFECTION

Before being placed into service, pipelines which convey potable water shall be disinfected in accordance with AWWA C651.

END OF SECTION

SECTION 02930
SEEDING AND RESTORATION

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers seeding to be performed after backfilling and final grading are complete. All areas disturbed by construction operations shall be treated as specified herein.
- B. All lawn, ditch, and shoulder areas that are damaged during the work shall be restored, after completion of construction, to the complete satisfaction of City of Milwaukee (City). All areas disturbed by contractor outside the work area shall be restored, at contractor's expense, to the satisfaction of the City. Occupying areas outside City property, street right-of-way, and utility easements for any purpose shall be done only with the written approval of the property owner and City.

1.02 GENERAL

- A. Governing Standard
 - 1. The governing standard for the seeding work shall be Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction.
- B. Experience
 - 1. All Work shall be performed by a licensed seeding contractor who is experienced in the type of work required.
- C. Completion
 - 1. Seeding work shall be completed at any time the City allows. At City's option, a portion of the final payment not to exceed one percent (1%) of the contract price may be retained until acceptable a grass stand in all seeded areas is established. Seeding requirements are as follows:
 - a) Locations to be seeded: Disturbed site work areas.
 - b) Area to be seeded: As required by the work on the drawings.

1.03 SUBMITTALS

- A. All submittals of drawings and data shall be in accordance with the requirements of Section 01010 and this section.
- B. Top Soil Source and Analysis
- C. Seed Composition and Analysis

1.04 GUARANTEE

- A. Contractor shall guarantee a uniform stand of seeding, free of weeds to the extent practical, and acceptable to City.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Shipping shall be in accordance with the shipping section. Handling and storage shall be in accordance with the handling and storage section.
- B. Prior to use, all products shall be kept dry and in a weatherproof location so that their effectiveness will not be impaired.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General
 - 1. All materials shall conform to the requirements of the governing standard, except where otherwise specified. The source of materials shall be submitted to the City for review.
- B. Top Soil
 - 1. Topsoil shall be fertile, natural, friable soil, suitable for the sustenance of plant life. Based on the mineral composition, the range of soil class accessible shall be in the silt loam to sandy loam range.
 - 2. It shall have a pH within the range of 6.0 to 7.5.
 - 3. It shall be free of weed seeds, extraneous materials, and toxic substances.
 - 4. It shall be stockpiled in sufficient quantity to supply the contract. The stockpile shall be subject to inspection and testing prior to approval and use.
- C. Starter Fertilizer
 - 1. Fertilizer shall be a complete pelleted fertilizer. The analysis in percent by weight shall be as follows:

Seeded Areas

Nitrogen	12%
Phosphorus	4%
Potassium	8%

- 2. Fertilizer shall be pre-mixed and packaged in standard size bags, showing weight, analysis, and name of manufacturer.
- D. Seed
 - 1. The seed mixture shall be Wisconsin Department of Transportation Seed Mixture No. 40 listed as follows:

<u>Species</u>	<u>Mixture Proportions</u>
Kentucky Bluegrass	35%
Red Fescue	20%
Hard Fescue	20%
Improved Fine Perennial Ryegrass	25%

2. Each bag of seed shall have a label securely attached showing at least ingredients, minimum crop seed and germination.
3. The selection of the seed mixture or mixtures for use on this project shall be submitted for approval prior to any sowing of the seeds.

PART 3 - EXECUTION

3.01 GENERAL

- A. Execution of seeding work shall conform to the governing standard, or shall be as specified herein, whichever is the most stringent.

3.02 SEEDING

A. Clearing

1. Prior to finish grading, areas to be seeded shall be cleared to remove any stumps, stones larger than 3 inch, roots, cable, wire, or other materials that might hinder subsequent seeding or maintenance

B. Finish Grading

1. Finish grading shall result in a surface conforming to the contours indicated on the drawings. Depressions shall be filled with top soil.

C. Application of Fertilizer and Lime

1. After finish grading, any fertilizer or lime specified shall be applied uniformly to areas to be seeded.
2. Fertilizer application rate shall be according to the manufacturer's recommended rate.
3. Following application, fertilizer shall be harrowed or disked into the soil.

D. Seed Application

1. Seed shall be applied within 72 hours after preparation of the seedbed. Seed shall be applied with equipment designed to give uniform application. Any method or combination of methods which uniformly distributes the seed directly in contact with the soil, covers the seed, and firms the bed, may be selected. Seed shall be placed approximately 1/4 inch below the surface at a rate of 2 lbs./1,000 sq. ft.

E. Mulching

1. All seeded areas shall be mulched within 24 hours following seed application. Mulch shall be anchored with a mulch anchoring tool designed to punch the mulch into the top surface of the soil at a minimum depth of 1½ inches. The mulching operation shall be in general accordance with the governing standard. Mulch shall be placed at a rate of 1½ to 3 tons/acre. Mulch material shall be straw.

3.03 WATERING

- A. Seeded areas shall be thoroughly watered after application of seed and mulch. Subsequent watering for seeded areas will not be required; however, contractor shall guarantee a uniform stand by seeding that is free of weeds to the extent practical, and acceptable to City.

3.04 REPLANTING

- A. Unacceptably seeded areas shall be overseeded or completely reseeded as instructed by City. Unless otherwise permitted by City, reseeding shall be performed during the next planting season.

3.05 MAINTENANCE

- A. All areas shall be maintained until final acceptance of the project. Maintenance shall include any necessary reseeding, repair of erosion damage, and replacement of displaced mulch until covered with seedlings. In the event erosion occurs from watering operations or rainfall, such damage shall be repaired.

END OF SECTION

SECTION 03301
CONCRETE

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and appurtenant work. All concrete shall be air-entrained.

1.02 GENERAL

- A. All cast-in-place concrete shall be accurately formed and properly placed and finished as indicated on the drawings and as specified herein.

1.03 SUBMITTALS

- A. All submittals of drawings and data shall be in accordance with the requirements of Section 01010 and this section.
- B. Schedule and Sequence of Placing Concrete.
- C. Drawings Showing Location of Construction Joints, if different from that shown.
- D. Concrete Mix Design.
- E. Certification for Aggregate Quality, including a statement from an independent laboratory that the aggregates to be used are not reactive.
- F. Product Data: Provide data on joint devices, attachment accessories, bonding agents, adhesive anchor systems and admixtures.
- G. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.04 STORAGE AND HANDLING

- A. Cement shall be stored in suitable moistureproof enclosures. Cement which has become caked or lumpy shall not be used.
- B. Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.
- C. Reinforcing steel shall be carefully handled and shall be stored on supports that will prevent the steel from touching the ground.

PART 2 - PRODUCTS

2.01 LIMITING REQUIREMENTS

A. General

- 1. Unless otherwise specified, concrete shall be controlled within the following limited requirements.

B. Cement Content

1. The quantity of Portland cement in the concrete shall be not less than that indicated in the following table:

Quantity of Cement (lb/yd ³)			
Coarse Aggregate Size from No. 4 Sieve to ---			
3/8 in.	1/2 in.	3/4 in.	1 in.
600	580	560	535

C. Maximum Water-Cementitious Ratio

1. The maximum water-cementitious ratio shall be 0.45 on a weight basis. If fly ash is used, the combined mass of cement plus fly ash shall be used to determine the water-cementitious materials ratio.

D. Fly Ash Content

1. At the option of the Contractor, fly ash may be substituted for up to 25 percent of the portland cement, but not less than 15 percent, on the basis of 1.0 lbs of fly ash added for each lb [kilogram] of cement reduction.

E. Coarse Aggregate

1. The maximum nominal coarse aggregate size shall be not larger than 1 inch [25 mm].

F. Slump

1. Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by the City, slump of concrete without a superplasticizer shall not exceed 4 inches. Slump of concrete with a superplasticizer, or a midrange water reducer, shall not exceed 8 inches.

G. Total Air Content

1. The total volumetric air content of concrete after placement shall be 6 percent \pm 1 percent.

H. Admixtures

1. The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations. A water-reducing admixture and an air-entraining admixture shall be included in all concrete. A midrange water reducer or a superplasticizer may be used at the Contractor's option. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.

I. Strength

1. The minimum acceptable compressive strengths, as determined by ASTM C39 with 6 inch diameter by 12 inch cylinders, shall be:

Age	Minimum Compressive Strength
7 days	3,375psi
28 days	4,500psi

2.02 MATERIALS

Cement	ASTM C150, Type II or I/II, low alkali.
Fly Ash	ASTM C618, Class F, except loss on ignition shall not exceed 4 percent.
Fine Aggregate	Clean natural sand, ASTM C33. Artificial or manufactured sand will not be acceptable.
Coarse Aggregate	Non-reactive crushed rock, washed gravel, or other inert granular material conforming to ASTM C33, class 4S, except that clay and shale particles shall not exceed 1 percent.
Water	Potable.
<u>Admixtures</u>	
Water-Reducing	ASTM C494, Type A or D.
Air-Entraining	ASTM C260.
Superplasticizing	ASTM C494, Type F or G.
<u>Reinforcing Steel</u>	
Bars	ASTM A615, Grade 60, deformed.
Welded Wire Fabric	ASTM A185 or A497.
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Mechanical Connector (Couplers or Form Savers)	Classified Type 2 per ACI 318-02 or per UBC-97. Use only where indicated on the drawings.
<u>Water stops</u>	
Metal, at construction joints	Uncoated carbon steel, 12 gage, size as indicated on the drawings.

PVC, at construction joints	Extruded, virgin, elastomeric, polyvinyl chloride (PVC), white (no pigment), flat, ribbed, 3/8 inch thick. Reclaimed material will not be acceptable. Provide hog rings or grommets spaced at 12 inches on center entire length.
For concrete sections less than 12 inches in thickness	6 inches wide, 3/8 thick; Greenstreak "679" or Vinylex "R6-38"
For concrete sections 12 inches or more in thickness	9 inches wide, 3/8 inch thick; Greenstreak "646" or Vinylex "R9-38"

Forms

Plywood Product	Standard PS1, waterproof, resin-bonded, exterior type, Douglas fir.
Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
Form Coating	Nonstaining and nontoxic after 30 days, VOCcompliant; Burke "Form Release (WB)", L&M Chemical "E Z Strip", Nox-Crete "Form Coating", or Symons "Thrift Kote E".
Pre-Cure Finishing Aid	Burke "Finishing Aid Concentrate", Euclid "Eucbar", L&M Chemical "E-Con", Master Builders "Confilm", or Sika "Sikafilm".

Membrane Curing Compound and Floor Sealer

VOC – EPA	ASTM C1315, Type I, Class A, maximum VOC 5.8 lb/gal [700 g/L], minimum 25 percent solids, acrylic, nonyellowing, unit moisture loss 0.40 kg/m ² maximum in 72 hours.
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2.03 PRELIMINARY REVIEW

- A. The source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the City for review before concrete is placed.

2.04 FORMS

A. General

- Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment.

2. Forms for pavement, curbs, or gutters shall be made of steel and shall be supported on thoroughly compacted earth. The top face of pavement forms shall not vary from a true plane more than 1/4 inch in 10 feet.
3. Forms shall be thoroughly cleaned and oiled before concrete is placed.
4. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be lapped at least 4 inches.

B. Form Ties

1. Form ties shall be of the removable end, permanently embedded body type, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders.

C. Edges and Corners

1. Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Unless otherwise noted, bevels shall be 3/4 inch wide.

D. Form Removal

1. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead, live, and construction loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

2.05 REINFORCEMENT

- A. Reinforcement shall be accurately formed and positioned and shall be maintained in proper position while the concrete is being placed and compacted. Unless otherwise indicated on the drawings, the details of fabrication shall conform to ACI 315 and 318. In case of conflict, ACI 318 shall govern.
- B. Reinforcement shall be free from dirt, loose rust, scale, and contaminants.
- C. Mechanical connections shall be used only as indicated on the drawings.

2.06 BATCHING AND MIXING

A. General

1. Concrete shall conform to ASTM C94 and shall be furnished by an acceptable ready-mixed concrete supplier.

B. Consistency

1. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall float uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

C. Delivery Tickets

1. A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to the City by the truck operator at the time of delivery. Tickets shall indicate the name and location of the concrete supplier, the project name, the mix identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

1. Contractor to verify all forms and reinforcement have been properly set and installed per drawings and specifications prior to placement of concrete.

B. Preparation of Existing Concrete

1. Prepare previously placed concrete by cleaning with steel brush or, (where indicated on the plans) by scarification to a minimum of 1/4 inch, and applying bonding agent in accordance with manufacturer's instructions.
2. In locations where new concrete is doweled to existing work, drill holes in existing concrete, clean holes, insert and adhesive anchor steel dowels into concrete. Hole size and use of adhesive anchor in accordance with manufacturer recommendations.

3. Bonding Agent

- a) Duralprep A.C., manufactured by Euclid Chemical Company.
- b) Arimatec 110, manufactured by Sika
- c) Daraweld C, manufactured by Grace Construction Products
- d) Approved Equal.

4. Adhesive Anchor Doweling System

- a) AC 100+ Gold Fastener by Powers Fasteners Inc.
- b) Acrylic-Tie by Simpson Strong Tie Company
- c) Approved Equal

3.02 PLACEMENT

A. General

1. The Contractor shall inform the City at least 24 hours in advance of the times and places at which he intends to place concrete.
2. Methods of conveying concrete to the point of final deposit and of placing shall prevent segregation or loss of ingredients. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Concrete shall be compacted by immersion-type vibrators, vibrating screeds, or other suitable

mechanical compaction equipment. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

3. Ensure reinforcement, inserts, embedded parts and formed expansion and contraction joints are not disturbed during concrete placement.
4. Place concrete continuously between predetermined expansion, control and construction joints.
5. Do not interrupt successive placement; do not permit cold joints to occur.

3.03 WATER STOPS

A. General

1. Each water stop shall be continuous throughout the length of the joint in which it is installed. Water stops shall be clean, free from coatings, and shall be maintained in proper position until surrounding concrete has been deposited and compacted.
2. Junctions between adjacent sections of metal water stops shall be lapped 5 inches and securely bolted, screwed, or spot welded together.
3. Junctions between adjacent sections of elastomeric (PVC) water stops shall be spliced in strict conformity with the recommendations of the manufacturer.
4. Directional changes and intersections shall be factory fabricated by the water stop manufacturer prior to delivery to the site of the work. Field splices will be acceptable only in straight sections.

3.04 FINISHING

A. General

1. Recesses from form ties shall be filled flush with mortar. Fins and other surface projections shall be removed from all formed surfaces, except exterior surfaces that will be in contact with earth backfill.
2. Unless otherwise specified, unformed surfaces shall be screeded and given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.
3. Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color and the completed finish for unformed surfaces unless indicated otherwise.

B. Troweling

1. Interior floor surfaces which will be exposed after construction is completed; exposed top surfaces of equipment bases and interior curbs; and other surfaces designated on the drawings shall be steel trowel finished. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall

produce a dense, smooth, uniform surface free from blemishes and trowel marks.

C. Application of Pre-Cure Finishing Aid

1. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with a pre-cure finishing aid. The finishing aid shall form a monomolecular film on the surface of fresh, plastic concrete to retard evaporation.
2. Immediately following screeding, pre-cure finishing aid shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray finishing aid at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.
3. The sprayable solution shall be prepared as recommended by the manufacturer.
4. Under severe drying conditions, additional applications of finishing aid may be required following each floating or troweling, except the last finishing operation.

3.05 CURING

A. General

1. Concrete shall be protected from loss of moisture by water saturation or by membrane curing for at least 7 days after placement; however, when concrete is also being protected from low temperatures, the period of curing by saturation shall be 1 day less than the duration of the low temperature protection.
2. Water saturation shall be used on concrete which will be covered later with mortar or additional concrete. Water saturation or membrane curing compound may be used on all other concrete surfaces.
3. Water saturation of concrete surfaces shall begin as soon as possible after initial set. Unformed surfaces shall be covered with polyethylene film, tarpaulins, or sand to retain the water. Water shall be applied as often as necessary to keep the concrete saturated for the entire curing period. Acceptable methods of water curing are described in ACI 308.
4. Membrane curing compound shall be sprayed at a coverage rate of not more than 300 square feet per gallon. Unformed surfaces shall be covered with curing compound within 30 minutes after final finishing. If forms are removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surfaces. Curing compound shall be suitably protected against abrasion during the curing period.
5. Concrete shall be protected against freezing for at least 8 days after placement.

3.06 REPAIRING DEFECTIVE CONCRETE

A. General

1. Defects in concrete surfaces shall be repaired to the satisfaction of the City. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges cut square to avoid feathering.
2. Concrete repair work shall conform to Article 5.3.7 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

3.07 FIELD CONTROL TESTING

A. Air Content

1. An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. The Contractor shall provide all equipment and supplies necessary for the testing. Air content shall be determined in accordance with ASTM C231.

B. Slump

1. A slump test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Slump shall be determined in accordance with ASTM C143.

C. Test Cylinders

1. Compression test specimens shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and C39.
2. Compressive strength tests will be evaluated in accordance with ACI 318 and as specified herein.
3. One set of 6 inch diameter by 12 inch concrete test cylinders shall be cast for each concrete pour. A set of test cylinders shall consist of four cylinders, two to be broken and to have compressive strengths averaged at 7 days, and two to be broken and to have compressive strengths averaged at 28 days. All concrete required for testing shall be furnished by, and at the expense of, the Contractor.
4. The cured cylinders shall be tested by an independent testing laboratory approved by the City at the expense of Contractor.

END OF SECTION

SECTION 03600
GROUT

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers procurement and installation of grout. Unless otherwise specified, only non-shrink non-metallic grout shall be furnished.

1.02 SUBMITTALS

- A. All submittals of drawings and data shall be in accordance with the requirements of Section 01010 and this section.
- B. A letter of certification indicating the types of grout to be supplied and the intended use of each type shall be submitted.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be handled, transported, and delivered in a manner which will prevent damage of any kind. Materials shall be protected from moisture.

PART 2 - PRODUCTS

2.01 NON-SHRINK NON-METALLIC GROUT

- A. Non-shrink non-metallic grout shall be furnished factory premixed so that only water is added at the jobsite.
- B. Non-shrink non-metallic grout shall be in accordance with ASTM C1107.

2.02 WATER

- A. Water shall be clean and free from deleterious substances.

PART 3 - EXECUTION

3.01 PREPARATION

- A. The concrete foundation to receive non-shrink grout shall be saturated with water for at least 12 hours preceding grouting unless additional time is required by the grout manufacturer.

3.02 INSTALLATION

- A. Mixing
 - 1. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

B. Placement

1. Unless otherwise specified or indicated on the drawings, grout under baseplates shall be 1-1/2 inches [38 mm] thick. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the baseplates are completely filled without voids. Forms shall be provided where structural components of baseplates will not confine the grout.

C. Edge Finishing

1. In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate.

D. Curing

1. Non-shrink grout shall be protected against rapid loss of moisture by covering with wet cloths or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 3 days and then an acceptable membrane curing compound shall be applied.

END OF SECTION

SECTION 09900
PAINING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all labor and materials to a complete painting job and related work as specified. The job consists of, but is not limited to, the following principal items:
 - 1. Blast cleaning and painting of interior surfaces of steel piping and butterfly valves.
 - 2. Touch-up painting of the exterior surfaces of the pipe and valve component surfaces that are damaged during reassembly as determined by the City.

1.02 GENERAL CONDITIONS

- A. All work performed and all material furnished and installed under this contract shall be in complete conformance with applicable sections of governing codes and standards; especially as required under U.S. Department of Labor-Occupational Safety and Health Act (OSHA) and United States Environmental Protection Agency (EPA).

1.03 SUBMITTALS

- A. All submittals of drawings and data shall be in accordance with the requirements of Section 01010 and this section.
- B. Provide product data on painting material.
- C. Submit manufacturers' application instructions.
- D. Submit paint color charts for approval.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
- B. Container labeling shall include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.
- C. Store paint materials at minimum ambient temperature of 45°F and a maximum of 90°F, in well ventilated area, unless required otherwise by manufacturer's instructions.
- D. Take precautionary measures to prevent fire hazards and spontaneous combustion.

PART 2 - PRODUCTS

2.01 STEEL PIPE & VALVE INTERIOR SURFACES

- A. Primer:

1. TNEMEC Series 20 Porta-Pox II or equal
 2. 8 mils Dry Film Thickness (DFT)
 3. Color: Approved by City
- B. Finish Coat:
1. TNEMEC Series 20 Porta-Pox II or equal
 2. 8 mils DFT
 3. Color: Approved by City

2.02 STEEL PIPE & VALVE EXTERIOR SURFACES

- A. Primer:
1. TNEMEC Series 30 or equal
 2. 8 mils DFT
 3. Color: Approved by City
- B. Finish Coat:
1. TNEMEC Series 30 or equal
 2. 8 mils DFT
 3. Color: Approved by City

PART 3 - EXECUTION

3.01 PROTECTION

- A. Protect elements surrounding the work from damage or disfiguration.
- B. Repair damage to other surfaces caused by the work.
- C. Furnish drop cloths, shields and protective methods to prevent dust, spray or drippings from disfiguring other surfaces. Electrical controls, gauges, pipe openings and other equipment shall be covered.

3.02 SURFACE PREPARATION

- A. Remove all dirt, mill scale, rust, paint, oxide, corrosion products and other foreign matter by commercial blast cleaning per SSPC-SP6. This preparation shall apply to all interior pump, pipe and valve parts.
- B. Remove all dirt, mill scale, rust, paint, oxide, corrosion products and other foreign matter by using hand held power tools to the extent of an SSPC-SP11 (Power tool cleaning to bare metal.) This preparation shall apply to the motor and exterior pump, pipe and valve parts.
- C. Roughen tightly adhered surfaces by using hand held disc abraders equipped with rough textured surface. Place extra emphasis on fasteners, fittings and gaps between flanges.

- D. Care shall be taken to roughen the substrate than polishing it. Blow down with compressed air before priming.

3.03 PAINT APPLICATION

- A. Apply paint in accordance with manufacturer's instructions.
- B. Paint application shall be by spray, roller or brush. Painting method shall be approved by the City.
- C. Coating shall be applied uniformly, free from runs, skips, streaks or brush marks.
- D. Allow a minimum of 24 hours to cure the first coat before applying second coat of paint.

3.04 CLEANING

- A. As work proceeds, promptly remove paint where spilled, splashed or spattered.
- B. During progress of work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Collect cotton waste, cloths and other material which may constitute a fire hazard; place in closed metal containers and remove from site daily.

END OF SECTION

SECTION 15100
PIPING, VALVES & FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Supply and install all steel piping modifications, valves and fittings relating to the removal of two (2) existing 60" diameter butterfly valves (BFV) and associated pipe and fittings. The Contractor shall supply and install two (2) new 60" diameter BFV's with electric motor actuators and modify the adjacent pipe to facilitate the valve installations. The steel piping modifications shall be complete with all fittings, flanges, couplings, anchors, anchor bolts, gaskets, bolts and nuts, pipe supports, appurtenances and accessories for proper installation and functioning of the piping system. The valves are designated as Valve #1 and #2 on the drawings.
- B. Supply and install one (1) new 72" diameter BFV designated as Valve #5 as shown on the drawings. This BFV shall be rated for direct bury service and be inserted into an existing 78" diameter Pre-Stressed Concrete Cylinder Pipe (PCCP). Installation shall include all required PCCP fittings, closure pieces, couplings, and restraints supplied by Contractor. Contractor shall supply and install the necessary valve box, extension rods, nuts, and indicator cover.
- C. Supply and install one (1) new 72" diameter BFV designated as Valve #4 as shown on the drawings. This BFV shall be rated for Direct Bury service and be inserted into an existing 90" diameter Pre-Stressed Concrete Cylinder Pipe (PCCP). Installation shall include all required PCCP fittings, closure pieces, couplings, and restraints supplied by Contractor. Contractor shall supply and install the necessary valve box, extension rods, nuts, and indicator cover.
- D. Supply and install one (1) new 72" diameter BFV designated as Valve #3 as shown on the drawings. This BFV shall be rated for Direct Bury service and be inserted into an existing 120" diameter Pre-Stressed Concrete Cylinder Pipe (PCCP). Installation shall include all required PCCP fittings, closure pieces, couplings, and restraints supplied by Contractor. Contractor shall supply and install the necessary valve box, extension rods, nuts, and indicator cover.
- E. See Specification Section 02612 for PCCP reference information for the above.

1.02 SUBMITTALS

- A. All submittals of drawings and data shall be in accordance with the requirements of Section 01010 and this section.
- B. The required SUBMITTALS shall include drawings, design calculations, specifications, piping and valve layouts and execution drawings.

NO PIPE, FITTINGS, VALVES OR SPECIALS SHALL BE MANUFACTURED UNTIL ALL SUBMITTALS HAVE BEEN APPROVED BY THE CITY.

PART 2 - PRODUCTS

2.01 STEEL PIPING

- A. Steel piping shall be Schedule 40. Pipe shall be of the nominal diameter (size) as indicated on the drawings and shall conform to all requirements of AWWA Standard C200, ASTM A139 Grade B, and ANSI B16.5. Piping shall be carbon steel and be one of the following:
 - 1. Seamless or ERW pipe manufactured according to ASTM A-53 Grade B.
 - 2. Spiral butt-weld pipe manufactured according to ASTM A-139 Grade B, ASTM A-252 Grade 2 or 3 and ASTM A-211.
- B. Fabricated steel pipe shall have all seams butt-welded. Pipe shall have no more than two (2) longitudinal seams. Girth seams shall be spaced not less than six (6) feet apart except in specials and fittings.

2.02 STEEL FLANGES

- A. All flanges shall be AWWA Class D, hub type, steel slip-on flanges conforming to the requirements of AWWA C207-07, Table 3. All flanges shall be flat faced with concentric or spiral serrated finish, shall be back-faced or spot-faced on the back and shall have bores suitable for the pipe on which they will be installed.

2.03 BOLTS AND NUTS

- A. Flanges shall be bolted with bolt-stud and nuts. Bolts for AWWA flanges shall be of the diameters set forth in Table 3 of AWWA C207-07. Bolts, studs and nuts shall be carbon steel A307, Grade B, without heat treatment other than stress relief. Bolt heads and nuts shall be hexagonal.

2.04 FLANGE GASKETS

- A. All flange gaskets shall be of the full-faced type and made from 1/16-inch Garlock Style 3000 "Blue-Gard Compressed Gasketing", or approved equal.

2.05 WELDED JOINTS

- A. Basic requirements for all welds are that they be sound, free from embedded scale and slag, have a tensile strength across the weld not less than that of the thinner of the connected sections, and that all pipe welds be water-tight. Butt welds shall be used for all shop-welded joints in pipe, fittings, and specials except where fillet welds are specified or shown. Fillet welds shall be used for flange attachment in accordance with AWWA C207-07, Section 4.3. Fillet welds shall also be used in fabrication of pipe reinforcement, and in other locations where shown on the plans. Weld test specimens shall be furnished whenever requested by the Inspector. This contractor shall adhere to the requirements of AWWA C206 and shall furnish the operator certificates prior to any field welding.

- B. The use of back-up welding strips or rings for shop or field butt welds will not be permitted. Welding of field joints shall conform to the applicable requirements of AWWA C206.
- C. Leaks in welds shall be repaired by removing the defective material which caused the leak in each case and re-welding. No leak shall be repaired by mechanical caulking.

2.06 PROTECTIVE COATING

- A. The interior surfaces of the steel pipes, specials and fittings shall be prepared, primed and coated in accordance with Section 09900 of the specifications and the paint manufacturer's recommendations.
- B. Interior valve surfaces shall be coated and painted in accordance with AWWA C504 and AWWA C507. Extreme care shall be taken to prevent damage to resilient seat material.
- C. Exterior surfaces shall be prepared, primed and coated in accordance with Section 09900 of the specifications and the paint manufacturer's recommendations.

2.07 BUTTERFLY VALVES – BURIED SERVICE (72")

- A. Valves shall be of the size indicated on the plans and shall be of the tight closing, rubber-seat type that fully complies with the latest revision of AWWA Standard C504 class 150B. Valves shall be satisfactory for throttling service and frequent operation. Valve discs shall rotate 90° from the full open position to the tight shut position. Angular misposition of the disc shall be 1° off center without leakage. Valves shall meet the following requirements:
 1. Valve Body and Flanges: All valve bodies shall be cast iron, ASTM A-126 Class B, narrow body design. Flange drilling shall be in accordance with ANSI B16.1 standard for cast iron flanges. Body thickness shall be in strict accordance with AWWA C504. All bolts and nuts shall be type 18-8 stainless steel.
 2. Valve Disc: All valve discs shall be constructed of ductile iron, ASTM A-536, with Type 18-8 stainless steel seating edge to mate with rubber seat on body. A built in adjustable stop shall limit disc rotation in the open position and shall limit disc rotation at any point between the one-half and the full open position. Disc and shaft connection shall be made with Type 18-8 stainless steel pins.
 3. Valve Shafts: All shafts shall be turned, ground and polished and constructed of Type 18-8 stainless steel conforming to ASTM A-276. Shafts shall be two-piece, stub-type keyed for operator connection. Shaft diameters shall meet minimum requirements of AWWA C504 for Class 150. Shaft seals shall be standard self-adjusting split V packing. Shaft seals shall be of a design allowing replacement without removing the valve shaft.
 4. Valve Seat: All seats shall be of a synthetic rubber compound such as BUNA-N and suitable for bi-directional shut-off at rated pressure. Seats

shall be retained in the valve body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow stream. Seats shall be a full 360° without interruption and have a plurality of grooves mating with a spherical disc edge-seating surface. All valve seats shall be field adjustable around the full 360° circumference and replaceable without dismantling the operator, disc or shaft and without removing the valve from the pipeline. Manufacturer shall certify that seat is field replaceable.

5. Valve Bearings: All valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating.
6. Valve Packing: The packing shall be V-type. All packing shall be self-adjusting and wear compensating. Valve packing arrangement shall be designed so that the actuator removal will not result in packing seal failure.
7. Painting: The Valve Interior and Exterior Surfaces except for seating shall be coated with Ameron Amercoat 370 in accordance with AWWA C550 and C504. All internal and/or external surfaces shall be covered with a polyamide cured epoxy coating applied over a sand blasted “new white metal surface” per SSPC-SP10 to a minimum of 6 mils in compliance with AWWA C550.
8. Valve Tests: Hydrostatic and leakage tests shall be conducted in accordance with AWWA C504 for Class 150. Valves shall be factory tested with proper written certification provided of meeting requirements. Valves shall also be field tested to verify that valve is tight closing and leak-free after operators are installed.
9. Proof of Design: The manufacturer furnishing valves shall provide written certification that the valves proposed meet the design requirements of AWWA C504.

B. MANUAL OPERATOR FOR BURIED SERVICE

1. Manual operator for the buried butterfly valves shall have all gearing totally enclosed. All fastenings shall be type 18-8 stainless steel.
2. Operator mounting arrangement will be indicated on shop drawings. Valves shall open in a “counter-clockwise” rotation, and close in a clockwise rotation.
3. Actuators shall be fully grease packed and have stops in the open/close position. The actuator shall have a mechanical stop which will withstand an input torque of 450 ft. lbs. against the stop. The traveling nut shall engage alignment grooves in the housing. The actuators shall have a built in packing leak bypass to eliminate possible packing leakage into the actuator housing.
4. All valves shall be equipped with a ground level position indicator that will visually indicate the position of the valve disc at all times. The

position indicator shall identify valve position at a glance, as well as direction and number of turns to open or close completely. Hermetically sealed, the internal gearing shall be protected from the elements with a clear, tough plastic cover. The position indicator assembly shall be supplied and installed by the Contractor and be complete with cast iron adapter, and cap screws, guide bushings, position indicator flexible washer, and a two-inch square AWWA nut with set screw. The adapter shall fit a standard 5 ¼ inch valve box. The ground level position indicator shall be the “DIVINER®” model as manufactured by Henry Pratt Company, or an approved equal.

C. WARRANTY

1. The rubber-seated direct bury butterfly valves and actuator units shall be warranted for a minimum of five (5) years from the date of installation.

D. VALVE MANUFACTURER

1. Butterfly valves for buried service and indicator accessories shall be as manufactured by:
 - A) Henry Pratt Company
 - B) DeZURIK
 - C) Milliken Valve Company
 - D) Approved Equal

2.08 BUTTERFLY VALVES NON-BURIED SERVICE (60’’)

- A. Valves shall be of the size indicated on the plans and shall be of the tight closing, rubber-seat type that fully complies with the latest revision of AWWA Standard C504 class 150B. Valves shall be satisfactory for throttling service and frequent operation. Valve discs shall rotate 90° from the full open position to the tight shut position. Angular misposition of the disc shall be 1° off center without leakage. Valves shall meet the following requirements:
 1. Valve Body and Flanges: All valve bodies shall be cast iron, ASTM A-126 Class B, narrow body design. Flange drilling shall be in accordance with ANSI B16.1 standard for cast iron flanges. Body thickness shall be in strict accordance with AWWA C504 where applicable.
 2. Valve Disc: All valve discs shall be constructed of ductile iron, ASTM A-536, stainless steel seating edge. A built in adjustable stop shall limit disc rotation in the open position and shall limit disc rotation at any point between the one-half and the full open position. Disc and shaft connection shall be made with stainless steel pins.
 3. Valve Shafts: All shafts shall be turned, ground and polished and constructed of 18-8 Type 316 stainless steel. Shafts shall be two-piece, stub-type keyed for operator connection. Shaft diameters shall meet minimum requirements of AWWA C504 for Class 150.

4. Valve Seat: All seats shall be of a synthetic rubber compound such as BUNA-N and be suitable for bi-directional shut-off at rated pressure. Seats shall be retained in the valve body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow stream. Seats shall be a full 360° without interruption and have a plurality of grooves mating with a spherical disc edge-seating surface. All valve seats shall be field adjustable around the full 360° circumference and replacement without dismantling the operator, disc or shaft and without removing the valve from the pipeline. Manufacturer shall certify that seat is field replaceable.
5. Valve Bearings: All valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating.
6. Valve Packing: On valve 30" and larger, the packing shall be V-type. All packing shall be self-adjusting and wear compensating. Valve packing arrangement shall be designed so that the actuator removal will not result in packing seal failure.
7. Painting: The Valve Interior and Exterior Surfaces except for seating shall be coated with Ameron Amercoat 370 in accordance with AWWA C550 and C504. All internal and/or external surfaces shall be covered with a polyamide cured epoxy coating applied over a sand blasted "new white metal surface" per SSPC-SP10 to a minimum of 6 mils in compliance with AWWA C550.
8. Valve Tests: Hydrostatic and leakage tests shall be conducted in accordance with AWWA C504 for Class 150. Valves shall be factory tested with proper written certification provided of meeting requirements. Valves shall also be field tested to verify that valve is tight closing and leak-free after operators are installed.
9. Proof of Design: The manufacturer furnishing valves shall provide written certification that the valves proposed meet the design requirements of AWWA C504.

B. MANUAL OPERATOR:

1. Manual operator for the butterfly valves shall have all gearing totally enclosed.
2. Operator mounting arrangement will be indicated on shop drawings.
3. Operators shall be as manufactured by Philadelphia Gear Corp. or an approved equal.
4. Each operator shall have a torque rating as hereby specified. Valve operators shall be designed to produce the specified out-put torque with a hand wheel pull of 40 pounds.
5. Hand wheels shall have a diameter of not greater than 24" for valves 30" or smaller, and a diameter of not greater than 30" for valves 36" and larger.

6. Each hand wheel shall rotate counterclockwise to open the valve. Hand wheels shall have cast thereon the word "OPEN" and an arrow indicating the direction to open.
7. Hand wheels shall be identified by tagging with valve number, or be securely mounted to the operator in the operating position at the factory before shipment.
8. All valves shall be equipped with a position indicator that will indicate the position of the disc at all times.

C. LIMIT SWITCHES

1. Four (4) limit switches shall be mounted on each valve in watertight enclosures and shall be used for indication of valve position.
2. Limit switches shall be securely mounted and shall be operated by the pointer of the valve position indicator.
3. One switch shall be arranged to have its contacts open only when the valve is full open, and the other shall be arranged to have its contacts open only when the valve is full closed. The contacts of both switches shall be closed when the valve is partially open. These contacts shall be of the heavy-duty type and shall be rated for at least 5 amperes at 250 VAC resistive.

D. WARRANTY

1. The rubber-seated butterfly valves and torque units shall be warranted for a minimum of five (5) years from the date of installation.

E. VALVE MANUFACTURER:

1. Butterfly valves shall be as manufactured by:
 - A) Henry Pratt Company
 - B) DeZURIK
 - C) Milliken Valve Company
 - D) Approved Equal

2.09 ELECTRIC MOTOR ACTUATORS

- A. The Non-Direct Bury 60" butterfly valves shall be positioning duty and shall be equipped with new electrical motor actuator, complete with motor, reduction gearing, hand wheel mechanism, limit switches, torque switch, lubricants, heating elements, internal wiring, etc., enclosed in waterproof and weatherproof type NEMA-4 construction. The electric motor actuator shall be the latest standard product of a manufacturer whose electric actuators have been produced and have given satisfactory operating service for a period of not less than five (5) years.

- B. Valve actuator shall conform to the operating requirements of the latest edition of AWWA standard C542 “Electric Motor Actuators for Valves and Slide Gates”, and as specified herein.
1. The rated torque capability of each actuator shall be sufficient to seat, unseat and rigidly hold in any intermediate position, the valve disc it controls under the operating conditions as specified.
 2. Valve actuator shall be equipped with adjustable mechanical stop limiting devices to prevent over-travel in the open and closed positions.
 3. Actuator housing supports and connections to the valve shall be designed with a minimum safety factor of 5, based on ultimate strength of the material used.
 4. The stall torque of the actuator shall not exceed the torque capability of the valve as determined by the valve manufacturer.
 5. Each valve actuator shall have an electrical circuit breaker disconnect switch mounted securely to the actuator housing.
 6. Each valve actuator shall have a 4-20 mA feedback signal transmitter installed, to indicate valve position to a remote indicator.
 7. Each valve actuator shall be equipped with an analog position indicator that shall utilize a remote, 4-20 mA input signal to control valve position in a range of 0% to 100%.
- C. Electric motor actuators shall be as manufactured by Limitorque L120 series, EIM TEC2000 series, or approved equal. Actuator manufacturer shall coordinate with the valve manufacturer to insure actuators are installed in an upright position, and shall be controlled by the City SCADA System.
- D. The valve manufacturer shall transmit the actuator sizing data, such as required torque, shaft diameter, thread characteristics and keyway dimensions to the actuator manufacturer for actuator sizing.

2.10 VALVE ACTUATOR MOTOR

- A. The motor shall be a high torque, low starting current, design made expressly for valve control service, and capable of operating the valve at the specified torque for continuous modulating service without overheating. The motor shall be capable of producing an actuator output of not less than one and one-half times the required valve operating torque. The motor shall be totally enclosed and non-ventilated, rated a minimum of 480VAC three phase and shall have minimum Class “B” insulation. The electric-motor enclosure shall meet NEMA 4, (National Electrical Manufacturers Association) watertight construction as a minimum. The motor shall operate successfully at any voltage within ± 10 percent of the specified voltage. The motor shall be sealed against the environment and protected against ingress of humidity and dust. Motors shall be factory lubricated for lifetime operation. Overload protection shall be by means of overload relays or inherent motor heat sensors embedded in the windings.

2.11 GEARING MECHANISM

- A. Reduction shall be accomplished by means of spur, helical, bevel and/or worm gears. Gears shall be steel. Worm gears shall be bronze. The use of non-metallic or aluminum gears is unacceptable. All gears and shafting shall be supported on anti-friction bearings. The unit shall be designed so that the motor comes up to full speed before the valve stem load is encountered in either the opening or closing operation. All gearing shall be designed for 100 percent overload conditions, permanently lubricated and effectively sealed against entrance of foreign matter. The unit shall be constructed to permit the reduction gear ratio to be changed if required. Gears shall be totally enclosed in waterproof housing with integrally cast mounting for motor and separate compartment with removable cover for limit controls.

2.12 HANDWHEEL MECHANISM

- A. The actuator shall be equipped with a hand wheel for manual operation. The hand wheel shall not rotate during motor operation and during hand wheel operation the motor rotor shall not turn. The drive unit shall be responsive to electrical control at all times and shall disengage the hand wheel instantly when the motor is energized. An arrow, indicating the direction of rotation, and the word "OPEN" or "CLOSE" shall be cast on the hand wheel. The hand wheel pull required to manually operate the valve shall not exceed 80 pounds on the rim for seating or unseating load or 60 pounds for running load.

2.13 LUBRICATION

- A. All gearing and bearings shall be grease or oil-lubricated. Seals shall be provided at all shaft penetrations of the gear case to prevent leakage of lubricant, regardless of position. Lubricants shall be suitable for year-round service based on prevailing ambient temperature conditions.

2.14 TORQUE SWITCHES

- A. The actuator shall include an adjustable torque-switch (and thrust-switch, where applicable) arrangement to break the control power circuit when a valve requiring torque seating has reached the fully open or fully closed position (stops), or when an obstruction has been encountered in either direction of travel. Open and close torque switches shall be adjustable by means of individually calibrated dials marked "OPEN" or "CLOSE". The torque spring supplied with the unit shall allow adjustment of torque to be increased a minimum of 25 percent beyond the required to open or close and seat the valve, i.e. the torque spring shall not be compressed beyond 75 percent of its travel to successfully close the valve. The gear head, gearing and valve capability required by the maximum torque switch setting specified above.

2.15 LIMIT SWITCHES

- A. Provisions shall be made on each valve electric operator for two (2) trains of geared limit switches, each train independently adjustable and with provisions for three (3) switch contacts. The switch contacts to be furnished shall be as follows:

- GLS/1: Contact open only when the valve is fully open, used to de-energize "OPEN" contact, and to turn off "GREEN" indicating light (Gear Train No. 1).
- GLS/2: Contact, open only when valve is fully closed; used to de-energize "CLOSE" contactor and to turn off "RED" indicating light (Gear Train No. 2).
- GLS/3: Contact, open only when the valve is fully open, used for supervisory control and remote indication (Gear Train No. 1).
- GLS/4: Contact, open only when the valve is fully closed, used for supervisory control and remote indication (Gear Train No. 2).
- B. The proper operation of limit switches is essential to the successful operation of the piping system.
- C. Open and close limit switches shall be geared to the drive mechanism and in step at all times whether the unit is operated electrically or manually. The switches shall be of the field-adjustable type capable of being set either fully open, fully closed, or at any intermediate position. Limit-switch gearing shall be appropriately lubricated and totally enclosed to prevent entrance of foreign material or loss of lubricant.
- D. Terminal strips, space heater, limit switches and torque switches shall be housed in compartment(s) integral to the actuator. Space heating elements shall be provided in both the motor housing and the geared limit switch compartment. The heating elements shall be rated for 208 VAC, and operate continuously energized. Terminal facilities for connection to motor leads, solenoid, switches and heaters shall be provided in the limit switch compartment. Threaded conduit hubs shall be provided for rigid conduit connections. As a minimum, the compartment(s) shall meet NEMA 4 watertight construction.

2.16 ELECTRICAL CONTROLS

- A. The valve controller shall be furnished by the manufacturer of the drive unit to insure complete compatibility of the equipment. The valve controller shall be housed in a NEMA 4 type enclosure with integral circuit breaker disconnect. The valve controller shall have two modes of operation; "REMOTE" and "LOCAL".
- B. The control and indication devices listed below shall be located on the front door of the enclosure:
1. Valve Closed Green Pilot Light NEMA 4/13
 2. Valve Open Red Pilot Light NEMA 4/13
 3. Valve Close Push Button Momentary NEMA 4/13
 4. Valve Open Push Button Momentary NEMA 4/13
 5. 2- Position Maintained Local/Remote Selector Switch NEMA 4/13

NOTE: Both red and green pilot lights shall be lit when the valve is in the intermediate position.

- C. The AC valve actuator shall include an electro-mechanical reversing AC motor starter and shall be suitable for operating at a rate of 1,200 starts per hour.
- D. Limit Switch Dry Contacts GLS/1, GLS/2, GLS/3, and GLS/4 shall be wired from the valve actuator to terminal blocks in the valve controller. The available limit switches from the terminal blocks shall be used as feedback to the PLC for means of control.
- E. REMOTE MODE:
 - 1. In "REMOTE MODE" the front door located valve open/close push buttons shall be disabled and the actuator shall use a micro-controller to perform valve positioning from a remote 4-20 mA input signal; and valve position shall be controllable in a range of 0% to 100%. The micro-controller shall convert the analog input to digital for processing and from digital back to a 4-20 mA analog output for position feedback.
- F. LOCAL MODE:
 - 1. In "LOCAL MODE", valve position shall be controlled via the momentary valve OPEN and CLOSE push-buttons on the local Display Module. The push-button must be maintained by the user to continuously apply power to the actuator.
- G. RELAY CONTACTS
 - 1. The valve controller shall be supplied with a minimum of four (4) configurable, Form C dry contact outputs, rated 5A , 250VAC. Contact outputs shall be provided and configured to indicate the following actuator/valve statuses as given below:
 - a. "VALVE FULL CLOSE", Normally Closed Contact; open only when the valve is fully open.
 - b. "VALVE FULL OPEN", Normally Closed Contact; open only when the valve is fully closed.
 - c. Selector switch in "REMOTE", Normally Open Contact
 - d. Selector switch in "LOCAL", Normally Open Contact

2.17 ACTUATOR TESTING

- A. Valve actuators shall be tested according to the test requirements of AWWA Standard C542. The tests shall prove that the design, material selection and manufacture of the actuator meet the requirements as specified. Performance test shall prove that each actuator is in working order prior to shipment. Test reports shall be submitted to the City for approval before the shipment of actuators to job-site.

2.18 NUMBER PLATES

- A. Valves shall have their number suitably shown on the valve operator. The motor operated valve shall also have the number suitably shown on the valve controller.

The location of number plates and method of attachment shall be subject to the approval of the CITY.

PART 3 – EXECUTION

3.01 INSTALLATIONS

- A. All steel piping and fitting valves shall be constructed to the lines and elevations shown on the drawings. In open or closed positions, valve stems shall not interfere with ceiling or other equipment.
- B. Flanged Joints: Care shall be taken in bolting flanged joints to insure that there is no restraint on the opposite end of the pipe, specials, fittings, and valves which would prevent pressure from being evenly and uniformly applied upon the gasket. The pipe or fitting must be free to move in any direction while bolting. Bolts shall be alternately tightened, each in turn, at a uniform rate of gasket compression around the entire flange.
- C. The inside of all pipes, valves and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand and dirt when erected. All lines shall be thoroughly flushed before placing in service

3.02 TESTS

- A. All piping, valves, and accessories installed under this contract shall be tested for tightness and leakage for a one-hour period. The contractor shall provide all necessary equipment and shall perform all work required in connection with these tests. Piping will be tested by observation at normal operating pressures. The section tested shall be slowly filled with water, care being taken to expel all air from the pipes. If necessary, the pipes shall be tapped at high points to vent the air. All joints which are found to leak shall be made tight by approved methods or replaced by the contractor at no additional cost to the City.

END OF SECTION

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 PROJECT OVERVIEW

- A. The electrical work included in all other divisions is the responsibility of the contractor performing the division 16 work unless noted otherwise.

1.02 SCOPE

- A. Basic Electrical Requirements, which are applicable to all Division 16 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1.03 REFERENCE STANDARDS

- A. Abbreviations of standards organizations referenced in this and other sections are as follows:
1. ANSI - American National Standards Institute
 2. ASTM - American Society for Testing and Materials
 3. EPA - Environmental Protection Agency
 4. ETL - Electrical Testing Laboratories, Inc.
 5. IEEE - Institute of Electrical and Electronics Engineers
 6. IES - Illuminating Engineering Society
 7. ISA - Instrument Society of America
 8. NBS - National Bureau of Standards
 9. NEC - National Electric Code
 10. NEMA - National Electrical Manufacturers Association
 11. NESC - National Electrical Safety Code
 12. NFPA - National Fire Protection Association
 13. UL - Underwriters Laboratories Inc.

1.04 REGULATORY REQUIREMENTS

- A. All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).
- B. All Division 16 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

1.05 QUALITY ASSURANCE

- A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.
- B. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.
- C. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by Milwaukee Water Works, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

1.06 CONTINUITY OF EXISTING SERVICES AND SYSTEMS

- A. No outages shall be permitted on existing systems except at the time and during the interval specified by Milwaukee Water Works. Any outage must be scheduled when the interruption causes the least interference with normal schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.
- B. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

1.07 SEALING AND FIRESTOPPING

- A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.08 INTENT

- A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

- B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits Milwaukee Water Work's intent (as determined by the Milwaukee Water Works Project Manager).
- C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.
- D. All sizes as given are minimum except as noted.
- E. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Milwaukee Water Works and/or Engineer's inspections, tests and approval from the commencement until the acceptance of the completed work.
- F. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

1.09 OMISSIONS

- A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Milwaukee Water Works to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.10 SUBMITTALS

- A. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
- B. On request from the Milwaukee Water Works, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
- C. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
- D. The submittals must be approved before fabrication is authorized.

E. Submit sufficient quantities of submittals to allow the following distribution:

- | | |
|--------------------------------------|----------|
| 1. Operating and Maintenance Manuals | 2 copies |
| 2. Engineer | 2 copies |
| 3. Field Office | 2 copy |

1.11 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Milwaukee Water Works before proceeding.
- C. Tools, materials and equipment shall be confined to areas designated by the Milwaukee Water Works.

1.12 WORK SEQUENCE AND SCHEDULING

- A. Install work in phases to accommodate project requirements. During the construction period coordinate electrical schedule and operations with Milwaukee Water Work's Construction Representatives.

1.13 WORK BY OTHER TRADES

- A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.
- B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.14 SALVAGE MATERIALS

- A. No materials removed from this project shall be reused. All materials removed shall become the property of and shall be disposed of by the Contractor.

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
1. Copies of all approved submittals
 2. Manufacturer's wiring diagrams for electrically powered equipment

3. Records of tests performed to certify compliance with system requirements
4. Certificates of inspection by regulatory agencies
5. Parts lists for manufactured equipment
6. Preventive maintenance recommendations
7. Warranties
8. Additional information as indicated in the technical specification sections

1.16 TRAINING OF MILWAUKEE WATER WORKS PERSONNEL

- A. Instruct Milwaukee Water Works personnel in the proper operation and maintenance of systems and equipment provided as part of this project; video tape all training sessions. Include not less than 40 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training sessions are to be held during normal working hours at the Florist Pumping Station. Furnish training materials for 10 Milwaukee Water Works employees.

1.17 RECORD DRAWINGS

- A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.
- B. Milwaukee Water Works will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.
- C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
- D. At completion of the project, the Contractor shall submit the marked-up record drawings to the Milwaukee Water Works prior to final payment.

PART 2 PRODUCTS

2.01 NON-RATED PENETRATIONS

- A. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
- B. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with section 02200 - Earthwork.

3.02 CONCRETE WORK

- A. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.03 EQUIPMENT ACCESS

- A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties.

3.04 COORDINATION

- A. The Contractor shall cooperate with other trades and Milwaukee Water Works personnel in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Milwaukee Water Works, provided such decision is reached prior to actual installation.
- B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- C. Cooperate with the testing consultant in ensuring specification Section 16020 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.

3.05 SLEEVES

- A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

- B. In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.
- C. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

3.06 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Penetrations:

1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

B. None-Rated Surfaces:

1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
2. Use galvanized sheet metal sleeves in hollow wall penetrations to provide a backing for the sealant. Grout area around sleeve in masonry construction.
3. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
4. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
5. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.07 HOUSEKEEPING AND CLEAN UP

- A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 16111
CONDUIT

PART 1 GENERAL

1.01 SCOPE

- A. Raceways shall be installed as a complete system continuous from service to outlet or equipment, mechanically and electrically connected, constituting a continuous ground system.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT AND FITTINGS

- A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.02 PVC COATED RIGID METAL CONDUIT

- A. PVC Externally Coated Conduit: Rigid heavy wall, schedule 40, steel conduit with external 40 mil (0.1 mm) PVC coating. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.
- B. Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

2.03 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized steel, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.04 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Conduit: Steel, galvanized tubing.
- B. Fittings: All steel, set screw, water tight, concrete tight. No push-on or indenter types permitted.
- C. Conduit Bodies: All steel threaded conduit bodies.

2.05 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: steel, galvanized, spiral strip.
- B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.07 ELECTRICAL NONMETALLIC TUBING (ENT) AND FITTINGS

- A. Conduit: ENT (smurf tube), UL listed and NEC recognized.
- B. Fittings: One piece quick connect fittings for 1/2 inch to 1 inch size and schedule 40 cemented fittings for larger size. When installed in concrete, fittings shall be suitable for damp locations and shall be concrete-tight, stub-ups and stub-downs kits shall meet manufacturer's recommendations.

2.08 RIGID NONMETALLIC CONDUIT AND FITTINGS

- A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90⁰ C conductors.
- B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.09 CONDUIT SUPPORTS

- A. See section 16190.

2.10 GENERAL

- A. All steel fittings and conduit bodies shall be galvanized.
- B. No cast metal, split or gland type fittings permitted.
- C. Condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.
- D. All conduit covers must be fastened to the conduit body with screws and be of the same manufacture.
- E. Wireways and gutters shall not be used in lieu of pull boxes and condulets.

PART 3 EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4" (50 mm) and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

- B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (13 mm) minimum except as specified elsewhere. **Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.**
- C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.
- D. Arrange conduit to maintain headroom and present a neat appearance.
- E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- F. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25% additional conduit.
- I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- J. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
- K. Supports shall be independent of the installations of other trades, e.g., ceiling support wires, HVAC pipes, etc., unless so approved or detailed.
- L. In general, all conduit shall be concealed except where noted on the drawings or approved by the architect/engineer. Contractor shall verify with architect/engineer all surface conduit installations except in mechanical rooms.
- M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- N. No continuous conduit run shall exceed 100 feet (30 meters) without a junction box.

3.02 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or pipecutter; de-burr cut ends.
- B. Conduit shall not be fastened to the corrugated metal roof deck.

- C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations (sheet metal boxes 4-11/16 inch square and larger, shall contain NO pre-punched or concentric knockouts).
- E. All conduit terminations (except for terminations into conduit bodies) shall use connectors or conduit hubs with one locknut or shall use double locknuts (one each side of box wall) and insulating bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 16170-Grounding and Bonding for grounding bushing requirements.
- F. Install no more than the equivalent of three 90 degree bends between boxes.
- G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.
- H. Conduit shall be bent according to manufacturers' recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.
- I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
- J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
- K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.
- L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
- M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
- N. Route conduit through roof openings for piping and ductwork where possible.
- O. Conduit is not permitted in any slab topping of 2 inches (50 mm) or less.
- P. Ground and bond conduit under provisions of Section 16170.
- Q. Maximum Size Conduit in Slabs Above Grade: 3/4 inch (19 mm). Do not route conduits to cross each other in slabs above grade.

- R. PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) or up through a concrete floor.
- S. Identify conduit under provisions of Section 16195.
- T. Use PVC-coated rigid steel factory elbows for bends in plastic conduit larger than 2 inch. PVC elbows are allowed in PVC conduit runs 2 inch and smaller.
- U. All conduit installed underground (exterior to building) shall be buried a minimum of 24 inches below finished grade, whether or not the conduit is concrete encased.
- V. PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturers' recommendations.
- W. Medium voltage conduit may be installed in interior locations other than electrical vaults only with special permission from Architect/Engineer.

3.03 CONDUIT INSTALLATION SCHEDULE

- A. Conduit other than that specified below for specific applications shall not be used.
- B. Exposed Outdoor Locations: Rigid steel conduit.
- C. Concealed in Concrete and Block Walls: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).
- D. Wet Interior Locations: PVC coated rigid steel conduit.
- E. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- F. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- G. Motor and equipment connections: Flexible PVC coated metal conduit (wet, damp, or dry locations). Flexible metal conduit (dry locations only). Minimum length shall be 1 foot (300 mm), maximum length shall be 3 feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
- H. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" (10 mm) minimum diameter and 6 foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.
- I. Medium Voltage Applications (Interior Locations): Rigid steel conduit.

END OF SECTION

SECTION 16123
BUILDING WIRE AND CABLE
(BELOW 600 VOLTS)

PART 1 GENERAL

1.01 SCOPE

- A. Furnishing and installing required wiring and cabling systems including pulling, terminating and splicing.

1.02 SUBMITTALS

- A. Submit under provisions of general conditions of Section 16010.
- B. Submit product data: Provide for each cable assembly type.
- C. Submit factory test reports: Indicate procedures and values obtained.

1.03 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.01 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper.
- C. Insulation shall have a 600 volt rating.
- D. In mechanical rooms, light fixtures, and other high temperature applications, the insulation shall be rated 90°C. Other areas shall use insulation rated 75°C unless stated otherwise in other parts of these specifications and drawings.
- E. All conductors must be suitable for the application intended. Conductors #10 and larger must be stranded. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
- F. All conductors terminated with crimp type devices must be stranded.

- G. Stranded conductors may only be terminated with UL or ETL listed type terminations or methods, e.g., stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.02 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits. Type XHHW-2 insulation for feeders with aluminum conductors.

2.03 UNDERGROUND WIRE FOR EXTERIOR WORK

- A. Description: Stranded single or multiple conductor insulated wire.
- B. Insulation: Type XHHW-2 or USE.

2.04 REMOTE CONTROL AND SIGNAL CABLE

- A. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together, [shielded], and covered with an overall PVC jacket. Cable shall be listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.
- B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.05 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable.
- B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
- C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- D. All wire connectors used in underground or exterior pull boxes shall be gel-filled twist connectors or a connector designed for damp and wet locations.
- E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
- F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.

PART 3 EXECUTION

3.01 GENERAL WIRING METHODS

- A. All wire and cable shall be installed in conduit. However, low voltage control and signal cables may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application unless specified to be in conduit in other sections of the specifications.
- B. Do not use wire smaller than 12 AWG for power and lighting circuits, 14 AWG for control wiring greater than 60 volts, or #18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.
- C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than
- D. 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).
- E. Make conductor lengths for parallel conductors equal.
- F. Splice only in junction or outlet boxes.
- G. No conductor less than 10 AWG shall be installed in exterior underground conduit (except low voltage cabling).
- H. Identify ALL low voltage, 600v and lower, wire per Section 16195.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.02 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

3.03 FREE-AIR CABLE INSTALLATION

- A. 'Free-Air' (exposed cabling) cable installation shall only be allowed with low voltage control or signal cables. No cabling shall be installed 'Free-Air' unless specifically noted on the drawings for each occurrence.

- B. When permitted in exposed ceiling areas, 'free-air' wiring runs shall avoid areas of high traffic (i.e., aisle way), shall be run as close as possible to outlining walls and shall be a minimum of ten (10) feet above finished floor.
- C. Cabling shall be neatly run at right angles and be kept clear of other trades work.
- D. Cabling shall be supported at a maximum of 4 foot intervals utilizing 'bridal-type' mounting rings anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12 inches, another support shall be provided. Mounting rings shall be designed to maintain cables bend to larger than the minimum bend radius (typically 4 x cable diameter).
- E. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical conduit. Additionally, cabling shall not be laid directly on the ceiling grid.
- F. To reduce or eliminate Electro-Magnetic Interference (EMI), the following minimum separation distances for 'Free-Air' cabling installations shall be adhered to:
 - 1. Twelve (12) inches from power lines of less than 5kV.
 - 2. Thirty-nine (39) inches from power lines of 5kV or greater.
 - 3. Eighteen (18) inches from lighting fixtures.
 - 4. Thirty-nine (39) inches from transformers and motors.
- G. A coil of 2 feet in each cable shall be placed in the ceiling at each 'free-air' wired device. These coils shall be secured (wire tied) at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
- H. All cable shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.
- I. Cable manufacturers minimum bend radius shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
- J. All exposed vertical cable extensions to devices located below the finished ceiling shall be in conduit.
- K. Provide protection for exposed cables where subject to damage.
- L. Control cables for controlling HVAC and lighting equipment connected to emergency power shall be routed in raceway.
- M. Use suitable cable fittings and connectors.

3.04 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.
- C. All splices shall be so made that they have an electrical resistance not in excess of 2 feet (600 mm) of the conductor.
- D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.05 WIRE COLOR

- A. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
- B. For wire sizes 8 AWG and larger - Identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
- C. Use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for listed whips mounted by the fixture manufacturer on the fixture and listed as a system.
- D. Neutral Conductors: White for 120/208V and 120/240V systems, gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with the proper circuit.
- E. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.
- F. Feeder Circuit Conductors: Each phase shall be uniquely color coded.
- G. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall provide green with yellow tracer.

3.06 BRANCH CIRCUITS

- A. The use of multi-wire branch circuits with a common neutral feeding load is not permitted.
- B. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductor.

3.07 EMERGENCY CIRCUITS

- A. All emergency system wiring shall be installed in raceways separate from all other systems.

END OF SECTION

SECTION 16130
BOXES

PART 1 GENERAL

1.01 SCOPE

- A. Wall and ceiling outlet boxes, floor boxes, pull and junction boxes for power, low voltage, fire alarm, and telecommunications including fiberoptic installations.

1.02 SUBMITTALS

- A. Submit product data under provisions of Section 16010.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

- A. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

2.02 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: Galvanized steel, with stamped knockouts.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
- C. Concrete Ceiling Boxes: Concrete type.
- D. Cast Boxes: Cast ferrous alloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.03 PULL AND JUNCTION BOXES

- A. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2-1/8 inch (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1-1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4-11/16 inch square (117 mm).
- B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1-1/4 inch and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.
- C. Sheet Metal Boxes: Code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

- D. Sheet Metal Boxes: Larger than 12 inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.
- E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.
- G. Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.
- H. Junction boxes 6 inch x 6 inch or larger size shall be without stamped knock-outs.
- I. Wireways shall not be used in lieu of junction boxes.

PART 3 EXECUTION

3.01 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on contract drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. No outlet shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
- D. It shall be the contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
- E. In case of any question or argument over the location of an outlet, the contractor shall refer the matter to the engineer and install outlet as instructed by the engineer.
- F. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the contractor for moving outlets which were improperly located.
- G. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors.
- H. Locate and install to maintain headroom and to present a neat appearance.

- I. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.02 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide minimum 24 inch (600 mm) separation in acoustic-rated walls.
- B. Power: Recessed (1/4 inch maximum) outlet boxes in masonry, concrete or tile construction shall be masonry type, minimum 4 inch square. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
- C. Low Voltage: Recessed (1/4 inch maximum) outlet boxes in masonry, concrete or tile construction shall be masonry type, minimum 4-11/16 inch square. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
- D. Provide knockout closures for unused openings.
- E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.
- F. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.
- G. Install boxes in walls without damaging wall insulation.
- H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- I. Ceiling outlets shall be 4 inch (100 mm) octagon or 4 inch square, minimum 2-1/8 inch (54 mm) deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans. All ceiling outlets shall be equipped with 3/8 inch (10 mm) fixture studs.
- J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

- N. Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.03 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install access panels in non-accessible ceilings where boxes are installed.
- B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 GENERAL

1.01 SCOPE

- A. Conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work.

1.02 SUBMITTALS

- A. Submit product data under the provisions of Section 16010.
- B. Product Data: Provide data for support channel.

1.03 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Support Channel: Galvanized.
- B. Hardware: Corrosion resistant.
- C. Minimum sized threaded rod for supports shall be 1”.
- D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when conduit is installed on the interior or exterior surface of any exterior building wall.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using expansion anchors, or spring steel clips (interior metal stud walls only).
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction.
- C. Do not use powder-actuated or plastic anchors.
- D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit.

- F. Do not drill structural steel members unless approved by engineer.
- G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3-1/2 inch concrete pads.
- I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet 1 inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE

- A. This section describes the products and execution requirements relating to labeling of power, lighting, general wiring, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie and riser) cables, terminating equipment and labeling of inner duct (fiber optic).

1.02 SUBMITTALS

- A. Submit shop drawings under provisions of Section 16010.
- B. Include schedule for nameplates and stenciling.
- C. Prior to installation, the contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8-1/2" x 11" sheets annotated, explaining their purposed use.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Labels: All labels shall be permanent, and machine generated. **NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.**
- B. Label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.
- C. Nameplates: Engraved three-layer laminated plastic, black letters on a white background. Emergency system shall use white letters on red background.
- D. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.
- E. Adhesive type labels not permitted except for phase and wire identification.

PART 3 EXECUTION

3.01 GENERAL

- A. Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.
- B. All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.
- C. Clean all surfaces before attaching labels with the label manufacturer’s recommended cleaning agent.
- D. Install all labels firmly as recommended by the label manufacturer.
- E. Labels shall be installed plumb and neatly on all equipment.
- F. Install nameplates parallel to equipment lines.
- G. Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside of recessed panelboards in finished locations.
- H. Embossed tape will not be permitted for any application.

3.02 JUNCTION AND PULLBOX IDENTIFICATION

- A. The following junction and pullboxes shall be identified utilizing spray painted covers:

<u>System</u>	<u>Color(s)</u>
Secondary Power – 480Y/277V	Brown
Secondary Power – 208Y/120V, 240/120V	White
Emergency Power – 480Y/277V	Brown/Red
Emergency Power – 208Y/120V	White/Red
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Blue
Video Surveillance System/MATV	Yellow

3.03 INNERDUCT LABELING

- A. All innerduct containing fiber optic cable installed under this project shall be labeled where exposed. This includes areas where the innerduct is (1) installed alone in risers, tunnels or trays, (2) where they transit manholes and/or pull boxes, and (3) in equipment rooms.
- B. The innerduct shall be labeled with a durable yellow polyethylene tag which reads “CAUTION FIBER OPTIC CABLE” and includes blank spaces for adding fiber count and destination information. The destination of the cable(s) contained in the innerduct and the fiber count shall be marked on the tag. Hand lettering is acceptable on this tag, using an indelible type ink.

- C. The tag shall be secured to the innerduct(s) using self-locking ties.
- D. Innerduct shall be labeled on each floor in a riser installation, in each manhole and/or handhole or at 25-foot intervals in a tunnel or tray installation.

3.04 POWER AND CONTROL WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
- B. All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.05 NAMEPLATE ENGRAVING

- A. Provide nameplates of minimum letter height as scheduled below.
- B. Panelboards, Switchboards and Motor Control Centers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.
- C. Equipment Enclosures: 1 inch (25 mm); identify equipment designation.
- D. Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch (13 mm); identify circuit and load served, including location.
- E. Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: 1/2 inch (13 mm); identify source and load served.
- F. Transformers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify primary and secondary voltages, primary source, and secondary load and location.
- G. Junction boxes: 1 inch (25 mm); identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

3.06 PANELBOARD DIRECTORIES

- A. Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be City's numbers, not plan numbers unless City so specifies.

END OF SECTION