Riverton Heights Park Improvements Project Manual

Project Address:
3011 S 148th Street
SeaTac, WA 98168

August 28, 2026

MxM LANDSCAPE ARCHITECTURE

922 25th Ave S
Seattle, WA 98144
206-310-7254

Project Manual
Riverton Heights Park Improvements

3011 S 148th Street SeaTac, WA 98168

City of SeaTac

4800 South 188th Street, SeaTac, WA 98188

Owner:

City of SeaTac
Clynn Wilkinson, Special Capital Project Manager
4800 South 188th Street, SeaTac, WA 98188
Tel: (206) 973-4755
cwilkinson@seatacwa.gov

Landscape Architect
MxM Landscape Architecture, LLC
922 25th Ave S,
Seattle, WA 98144
Tel: (206) 310-7254
info@mxmla.com
brice@mxmla.com
tim@mxmla.com

Civil Engineer
Toole Design Group
720 3rd Ave, Ste 2020
Seattle, WA 98104
Tel: (206) 297-1601 x337

Electrical Engineer
GDM, Inc
1584 McNeil St, Ste 200
Dupont, WA 98327
Tel: (306) 318-7095

Structural Engineer
Lund Opsahl
1215 Fourth Ave, Ste 1200
Seattle, WA 98161
Tel: (206) 402-5156

Mechanical Engineer
Stantec
1800 9th Ave, Ste 900
Seattle, WA 98101
Tel: (206) 224-3633

SECTION 000010
TABLE OF CONTENTS

DIVISION 0

Project Title Page	000001
Table of Contents	000010
Invitation to Bid	000010
Bidders Checklist	00110
Instructions to Bidders	00200
Bid Proposal	00300
Bid Bond	00410
Bidders Qualifications	00420
Subcontractor List & Qualifications	00430
Debarment Certification	004546
Certificate of Non-Segregated Facilities	00460
Non-Collusion Affidavit	00481
10% Subcontractor List	000485
Contract	00500
Performance and Payment Bonds	00600
Retained Percentage	00700
General Conditions	00800
Modification of General Conditions	00850
State Requirements	00900

DIVISION 1

Summary of Work	01100
Price and Payment Procedures	01230
Administrative Procedures	01300
Project Management and Coordination	01310
Submittal Procedures	01330
Quality Requirements	01400
References	01420
Temporary Facilities and Controls	01500
Tree, Plant and Soil Protection	015639
Product Requirements	01600
Substitution Requests	01635
Closeout Procedures	01770

DIVISION 3

Cast in Place Concrete	033000
Exposed Aggregate Finishing	033533

DIVISION 13

Common Work Results for Water Recreation Systems	131105
Sleeves and Sleeve Seals for Water Recreation Systems	131117
Vibration and Seismic Controls for Water Recreation Systems	131148
Spray Park Systems	131510
Spray Park Piping	131513
Spray Park Pumps	131516
Spray Park Water Treatment Equipment	131519
Spray Park Water Features	131523

DIVISION 22

Common Work Results for Plumbing	220500
Meters and Gages for Plumbing Piping	220519
General Duty Valves for Plumbing Piping	220523
Hangers and Supports for Plumbing Piping and Equipment	220529
Heat Tracing for Plumbing Piping	220533
Identification for Plumbing Piping and Equipment	220553
Plumbing Piping Insulation	220719
Facility Water Distribution Piping	221113
Domestic Water Piping Specialties	221119
Sanitary Waste and Vent Piping	221316
Sanitary Waste Piping Specialties	221319
Submersible Sewerage Pump Systems	223329
Electrical Commercial Water Heaters	223336
Emergency Plumbing Fixtures	224500

DIVISION 23

Common Work Results for HVAC	230500
Hangers and Supports for HVAC Piping and Equipment	230529
Testing, Adjusting, and Balancing for HVAC	230593
Duct Installation	230713
Requirement for Startup	230810
HVAC Ducts and Casings	233100
Air Duct Accessories	233300
Fans	233400
HVAC Power Ventilators	233423
Air Outlets and Inlets	233700

DIVISION 26

Low-Voltage Electrical Power Conductors and Cables	260519
Grounding and Bonding	260526
Hangers and Supports for Electrical Systems	260529
Conduit for Electrical Systems	260533.13

Boxes for Electrical Systems	260533.16
Identification for Electrical Systems	260553
Power System Studies	260573
Lighting Control Devices	260923
Panelboards	262416
Wiring Devices	262726
Fuses	262813
Enclosed Switches	262816.16
Surge Protection Devices	264313
Interior Lighting	265100
Exterior Lighting	265600

DIVISION 27

Common Work Results for Communications	270500
Grounding and Bonding for Communications Systems	270526
Identification of Communications Systems	270553
Commissioning of Communications	270800
Communications Cabinets, Racks, Frames and Enclosures	271116
Communications Termination Blocks and Patch Panels	271119

DIVISION 28

Common Work Results for Electronic Safety and Security	280500
Conductors and Cables for Electronic Safety and Security	280513
Grounding and Bonding for Electronic Safety and Security	280513
Conduits and Backboxes for Electronic Safety and Security	280528.33
Commissioning of Electronic Safety and Security Systems	280800
Video Surveillance Systems	282000

DIVISION 31

Earthwork	310000
Site Preparation	311000
Playfield Subgrade Establishment	312216

DIVISION 32

Synthetic Athletic Field Turf Base	321123.23
Asphalt Paving	321216
Cement Concrete Paving	321313
Pavement Markings and Signage	321700
Infilled Synthetic Turf System	321723.28
Playground Surfacing Tiles	321816.13
Chainlink and Site Fencing	323113
Site Furnishings	324100
Landscape Boulders and Stones	325000
Irrigation Systems	328000

Soil Preparation 329113
Seeding 329219
Landscape Planting 329300
Plants 329301
Transplanting 329600

DIVISION 33
Water Distribution Piping 331100
Sewage Piping 333113
Storm Drainage Utilities 334000
Underground Detention Systems 334010
Stormwater Media Cartridge Filtration System 334020
Playfield Subsurface Drainage 334616
Pipe Underdrains 334616.19

END OF SECTION

CITY OF SEATAC

NOTICE TO CONTRACTORS

Notice is hereby given that the City of SeaTac will receive sealed bids to SeaTac City Hall, third floor reception desk, 4800 South 188th Street, SeaTac, Washington, 98188 until **11:00 a.m. local time on September 24, 2026.** The bids received will be publicly opened and read after **11:15 a.m. local time** in the Riverton Conference Room 128 at City Hall, for construction of the project hereinafter referred to as:

RIVERTON HEIGHTS PARK IMPROVEMENTS

At said time all bids will be opened and publicly read aloud. Each bid shall be accompanied by a bid deposit as described below. No bid will be considered unless accompanied by such bid deposit. All proposals must be made upon the regular forms provided in the Proposal Section of the contract documents. Incomplete proposals and proposals received after the time stated above will not be considered. Faxed or emailed proposals will not be considered.

The work to be performed under these specifications consists of furnishing all labor, tools, materials, and equipment necessary for construction of the RIVERTON HEIGHTS PARK IMPROVEMENTS. Specific work includes, but is not limited to, providing a new spray park, installing a prefabricated restroom/mechanical building, new pathways, a turfed play field, fencing, plantings, and installing public art and other work described in construction documents.

The City will not sell bid packages.
Bid Documents are made available as follows:

Free-of-charge access to project bid documents (plans, specifications, addenda, and Bidders List) is provided to Prime Bidders, Subcontractors, and Vendors by going to www.bxwa.com and clicking on "Posted Projects", "Public Works", and "City of SeaTac". This online plan room provides Bidders with fully usable online documents with the ability to: download, view, print, order full/partial plan sets from numerous reprographic sources, and a free online digitizer/take-off tool. It is recommended that Bidders “Register” in order to receive automatic e-mail notification of future addenda and to place themselves on the “Self-Registered Bidders List". Bidders that do not register will not be automatically notified of addenda and will need to periodically check the on-line plan room for addenda issued on this

project. Contact Builders Exchange of Washington at (425) 258-1303 should you require assistance with access or registration.

An optional Pre-Bid Conference will be held at the project site at 8:30am on Wednesday, September 9, 2026.

Questions regarding this project shall be submitted in writing to MxM Landscape Architecture and The City of SeaTac via email at tim@mxmla.com, brice@mxmla.com, and cwilkinson@seatacwa.gov no later than 11:00 AM on Wednesday, September 16. **Questions via phone will not be accepted.**

All bid proposals shall be accompanied by a bid deposit in cash, certified check, cashier's check, or surety bond in an amount equal to five percent (5%) of the amount of the bid proposal. Bidder must use the bond form included in the contract provisions. Should the successful bidder fail to enter into such contract and furnish satisfactory performance bond within ten (10) calendar days of notification of intent to award contract, the bid proposal deposit shall be forfeited to the City of SeaTac.

The City reserves the right to reject any and all bids and to determine minor irregularities or informalities, and to waive any minor irregularities or informalities. No bidder may withdraw their bid for a period of forty-five (45) days after the date and time set for the opening thereof. Bid securities of the three lowest bidders may be held by the City until official award of the contract.

The successful bidder will be required to comply with all local, State, and Federal laws and regulations pertaining to equal employment opportunities.

Published: Daily Journal of Commerce – September 3, 2026 and September 10, 2026
Seattle Times – September 3, 2026 and September 10 2026

END OF SECTION

SECTION 00110
BIDDER'S CHECK LIST

The bidder's attention is especially called to the following forms which must be executed in full as required and submitted with the bid. Failure to complete these forms and to submit said forms with the bid, shall be due cause for rejection of bid.

1. Proposal
   The lump sum bid and alternate bid items must be shown in the spaces provided.

2. Proposal Signature Sheet
   To be filled in and signed by the Bidder

3. Bid Bond
   No bond form other than the form provided within these specifications shall be acceptable to the contracting agency. The form shall be executed by the Bidder and the surety company unless bid is accompanied by a certified check. The proposal bond shall not be altered, conditioned, or modified in any way. The amount of this bond shall be not less than five percent (5%) of the total amount bid and may be shown in dollars or on a percentage basis.

4. Statement of Bidder's Qualifications
   To be filled in and signed by the bidder.

5. Subcontractor List
   Identify any subcontractors doing more than 10% of the work.

6. *Infilled Synthetic Turf System materials per specification section 32 17 23.28 noted as "with the bid."*

7. Statement of Non-Segregated Facilities
   Complete the Statement and submit with the Bid Proposal.

8. Non-Collusion Affidavit
   To be signed and submitted with the bid.

9. Have you acknowledged receipt of Addenda (if applicable)?

10. Bid proposal to be submitted in a sealed envelope marked *"Bid Enclosed for Riverton Heights Park Improvements"*

END OF SECTION

SECTION 00200
INSTRUCTIONS TO BIDDERS

1. SCOPE OF WORK

   A. The project is the RIVERTON HEIGHTS PARK IMPROVEMENTS. The work to be performed shall include furnishing all labor, materials and equipment necessary for the construction of the above referenced project, related appurtenances, and performing all work as required by the contract in accordance with the Contract Drawings, Specifications and Standard Specifications, Instructions to Bidders, and all contents of the Project Manual, all of which are made a part hereof.

2. BID SCHEDULE

   A. Each bidder shall submit a proposal for the base bid together with all Alternate Bids.

3. PREPARATION AND SUBMISSION OF BID

   A. Each bid must be submitted on the enclosed form. Do not use or remove form bound within the specifications. All blank spaces for bid prices must be filled in, either in ink or typewritten. The Base Bid and Alternates, must be stated in both words and figures. Each bid, accompanied by Bid Guarantee, Statement of Bidder's Qualifications, Non-Collusion Affidavit, Statement of Non-Segregated Facilities, and the Statement of Proposed Subcontractors, fully completed and executed, must be submitted in a sealed envelope bearing on the outside the name of the bidder, his address, and the name "RIVERTON HEIGHTS PARK IMPROVEMENTS".

   Bids shall be submitted to the City Clerk's Office, City Hall, 4800 S 188th St, SeaTac, WA 98188. Bids will be received until 11:00 a.m., Monday, September 24, 2026

4. TELEGRAPH or FAX MODIFICATION

   A. No telegraphic or fax modifications will be allowed.

5. QUALIFICATIONS OF BIDDER

   A. Each bidder must furnish a statement of his construction experience and general ability to perform the work on the "Statement of Bidder's Qualification" form included in the Specifications. The Owner may take such investigations as he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligation of the

contract and to complete the work contemplated therein. In addition, the Contractor covenants that he is registered and licensed as required by the laws of the State of Washington.

6. QUALIFICATIONS OF SUBCONTRACTORS

A. The Owner reserves the right to approve or reject the subcontractors identified in the Bid Forms, after bid opening, providing the Contractor has the right to decide not to enter into the contract if the Owner so exercises the right to disqualify a subcontractor.

7. CONDITIONS OF THE WORK

A. Each bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his obligations to furnish all material and labor necessary to carry out the provisions of his contract.

B. Insofar as possible the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

8. ADDENDA AND INTERPRETATIONS

A. No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally.

B. Every request for such interpretation should be in writing addressed to MxM Landscape Architecture, and to be given consideration must be received no later than 11:00am Wednesday September 16, 2026. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be mailed and faxed not later than three (3) days prior to the date fixed for the opening of bids. Failure of any bidder to receive such addenda or interpretation shall not relieve any such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.

9. SECURITY FOR FAITHFUL PERFORMANCE

A. Simultaneously with his delivery of the executed contract, the Contractor shall furnish a surety bond or bonds AS DESCRIBED IN SECTION 006000, as required by RCW 39.08.010, as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be duly authorized by a surety company satisfactory to the Owner.

10. BID GUARANTEE

A. The Bid Guarantee shall be a certified check, a cashier's check, or a bid bond AS DESCRIBED IN SECTION 004100 made payable to the owner for an amount equal to at least 5% of the Base Bid. The Owner reserves the right to hold the bid guarantees of all bidders until the successful bidder has entered into the contract and furnished the required guarantee bond, or for a period of 45 days, whichever is the shorter time.

B. The bidder winning the award of this project will be required to submit the following documents to the City, within 14 days of notice of award.

a. Three (3) executed copies of the contract.
b. Contract bond or equivalent performance bond
c. Public Liability and Property Damage Insurance
e. Affidavit of Intent to Pay Prevailing Wages.

C. Should a bidder fail to enter into contract and furnish required documents within 14 days after his proposal has been accepted, his bid guarantee shall be retained by the Owner as liquidated damages, not as a penalty.

11. POWER OF ATTORNEY

A. The surety shall be bound by an Attorney-in-fact, resident in King County preferably, but certainly of the State of Washington. Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney. The seal of the bonding company is required on all performance bonds.

12. LAWS AND REGULATIONS

A. The bidder's attention is directed to the fact that all applicable Federal, State and Municipal ordinances and regulations and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written in full.

13. NON-COLLUSION AFFIDAVIT

A. Each bidder shall complete and properly execute the Non-Collusion Certificate included in these specifications and shall submit same as a part of his bid proposal.

14. METHOD OF AWARD - LOWEST QUALIFIED BIDDER

A. It is the intent of the Owner to award the Contract to the Contractor submitting the lowest bid within the funds available for work included in the Base Bid and any alternates selected, in any order.

15. OBLIGATION OF BIDDER

A. At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the specifications and contract documents (including any addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect to his bid.

16. TIME OF COMPLETION

A. The Contractor shall complete the work in all respects within 150 calendar days from date of written notice to proceed. It is anticipated that the Community Center within the Park and adjacent to the project site will be fully operational during the project. Contractor shall maintain access to the Community Center, the neighboring facilities at all times.

17. LIQUIDATED DAMAGES

A. Completion time is an important aspect of the project. Liquidated Damages shall be assessed at the rate of $250.00 for each calendar day that the work is not completed within the specified time of completion.

18. PREVAILING WAGE RATES

A. The prevailing rate of wages to be paid all workmen, laborers or mechanics employed in the performance of any part of this contract shall be no lower than the schedule of prevailing wage rates for the locality or localities where this contract will be performed, as determined by the Industrial Statistician of the Department of Labor and Industries, which are, by reference, made a part of this contract as though fully set forth herein.

Inasmuch as the Contractor will be held responsible for paying the prevailing wages, it is imperative that all Contractors familiarize themselves with the current wage rates before submitting bids based on these specifications. In case any dispute arises as to what are the prevailing rates of wages for work of a similar nature and such dispute cannot be adjusted by the parties in interest, including labor and management representatives, the matter shall be referred for arbitration to the Director of the Department of Labor and Industries of the State of Washington and his decision therein shall be final and conclusive and binding on all parties involved in the dispute as provided for by RCW 39.12.060 as amended.

The Contractor, on or before the date of commencement of work, shall submit to the owner, and with the Director of Labor and Industries, a "Statement of Intent to Pay Prevailing Wages." Following the acceptance of the project, the Contractor and each Subcontractor shall submit an "Affidavit of Wages Paid" certifying that all prevailing wage requirements have been satisfied. Such statements and any supplemental statements which may be necessary shall be filed in

accordance with the practices and procedures required by the Department of Labor and Industries.

Following the acceptance of the project, the Contractor and each subcontractor shall submit an "Affidavit of Wages Paid" certifying that all prevailing wage requirements have been satisfied.

A check, made payable to the Department of Labor and Industries, shall accompany each Statement of Affidavit sent to the State. All costs associated with these tasks should be considered as incidental and the Contractor should reflect these expenses into other bid items. The City will not separately reimburse the Contractor for these costs.

19. DUMP SITES

A. Prior approval of dump sites shall be obtained from the City before any waste material is deposited within the City limits. A fill permit will be required for all fills that are within the City limits and away from the project site.

20. LIMITATIONS REGARDING CONTRACTOR'S CLAIMS FOR DAMAGES

A. BIDDER IS HEREBY INFORMED that all claims to the City for all work and damages of any kind arising from this contract, shall be limited to the maximum amount appropriated by the City for this project. Funds for this project are limited and are public funds derived through Federal, State, Utility and or City taxes or property assessments appropriated for this project through the budgeting process. The City's decision to award this project is based upon the supposition that all costs will be held within the appropriated amount. The total project appropriation shall be as stated in the City budget authorizing the work herein. In the event the project funding or appropriation equals the amount under contract and an irreconcilable dispute between the City and the Contractor which the Contractor views as a breach of contract by the City excusing the Contractor from further performance, the Contractor and the City may agree to increase the project appropriation and preserve the rights of both parties to future settlements or final resolution by a court of law.

B. BIDDER AGREES AS A CONDITION OF BIDDING FOR THE WORK HEREIN, to limit all claims for extra work or damages of any kind whatsoever relating to this contract to prices established by the units and lump sums bid herein and/or direct costs as provided under the force account provisions of APWA, Section 1-09.6. By acceptance of a contract for the work herein, Contractor waives all claims for payment of damages which include or are computed on total costs of job performance, extended overhead, or other similar methods which do not relate to the prices stated herein or are not specific as to the actual, direct costs of contract work as defined in the APWA force account provisions.

C. The above stated limitations on claims for damages shall apply only to disputed claims and shall not be construed to apply to payments for extra work pursuant to mutually agreed change orders or force account work in accordance with Sections 1-04.4 and 1-09.6 of the

APWA Standard Specifications incorporated herein; and is specifically understood that the City shall be responsible to appropriate funds for all work performed in accordance with Section 1-04 of the APWA Standard Specifications.

21. CITY OF SEATAC

A. It should be noted that the City of SeaTac as project Owner is distinct in dealings and responsibilities from the City of SeaTac as building official and regulatory agency regarding compliance with existing ordinances, etc.

22. EQUAL OPPORTUNITY EMPLOYER

A. The City of SeaTac is an Equal Opportunity Employer.

END OF SECTION

SECTION 00300
BID PROPOSAL

Bidder.....

Date .....

To: City Council
City of SeaTac
4800 South 188th Street
SeaTac, Washington 98188

The undersigned bidder declares that it has carefully examined the Plans and Specifications, Notice to Contractors, Instructions to Bidders, Standard Specifications, General Provisions, Special Provisions, Appendix, Proposal, and contract for the construction of the above referenced project. The undersigned bidder also declares that it has investigated the project site to determine the conditions to be encountered, and that if this proposal is accepted it will enter into contract with the City of SeaTac, Washington, in the Form of Contract hereto affixed, will, to the extent required, provide the necessary equipment, tools, apparatus, and other means of construction, and will furnish all labor and materials as specified in these Contract Documents, or as called for in the plans, or necessary to complete the work in the manner herein specified and according to the requirements of the Engineer.

By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of $10,000 or more and that it will retain such certifications in its files.

The undersigned bidder certifies that this Proposal is in all respects fair and is made without collusion on the part of any person, firm or corporation mentioned below, and no officer or employee of the City of SeaTac is personally or financially interested, directly or indirectly, in the Proposal or in any purchase of or sale of any materials or supplies for the work to which it relates, or any portion of the profits thereof.

Accompanying this Proposal is a bid deposit or bid bond in the amount of five percent (5%) of the Proposal according to the conditions of the "Notice to Contractors" and "Instructions to Bidders" hereby attached. If this Proposal shall be accepted by the City of SeaTac, Washington, and the undersigned shall fail to execute a satisfactory contract and bond, as stated in the Instructions to Bidders hereto attached, within ten (10) days from the date of notification, then the City may, at its option, determine that the undersigned has abandoned the Contract and thereupon this Contract shall be null and void and the amount of the bid bond or certified check accompanying this Proposal shall be forfeited and become the property of the City of SeaTac, Washington.

The undersigned bidder understands that the quantities mentioned herein are approximate only and are subject to increase or decrease, and hereby proposes to perform all quantities of work as either increased or decreased in accordance with the provisions of the Drawings and Specifications and at the unit prices bid in the Bid Schedule, unless such schedule designates lump sum bids, or force account items.

Bidder has reviewed the third party liability insurance provisions of the Standard Specifications and hereby certifies that coverage will be provided as required. Yes _____ No _____

The undersigned bids and agrees to complete all construction of the Valley Ridge Sports Fields Improvements for the following:

BASE BID (As shown on the drawings and as defined in Section 01230)

	Quantity	Unit	Unit Price	Total Price
1. Base Bid Work	1	LS	$_____	$_____

Base Bid Total_____ $_____
Words *Figures*

NOTE: Do not include sales tax.

ADDITIVE ALTERNATES
The Undersigned agrees to perform the additions called for in the following Alternates, as shown on the drawings and as described in Specification Section 01230, PRICE AND PAYMENT PROCEDURES, for the following additions to the BASE BID. All items are complete and installed price.

NOTE: Do not include sales tax.

ITEM No.	Approx. Qty.	ITEM	AMOUNT Dollars Cts
A.	Lump Sum	Tile Surfacing for Existing Play Area	
		_____ *Words*	$_____ *Figures*

None of the above prices include sales tax.

Bidder hereby acknowledges receipt of Addenda _____ through _____.

_____
CONTRACTOR (Firm Name)

_____ _____
Signature of Authorized Agent | Name and title of person signing

_____ _____
Dated at | Date

_____ _____
Washington State Contractor's Registration Number | Contractor's Industrial Insurance Account Number

_____
Uniform Business Identification (UBI) Number

Contractor Address:

_____ _____

Telephone Number

_____

_____ _____

Fax Number

The name and mailing address of the Surety Company which will furnish the required Performance Bond is:

_____

_____

_____

Bid proposal must be submitted in a sealed envelope marked
"Bid Enclosed for RIVERTON HEIGHTS PARK IMPROVEMENTS"

END OF SECTION

CITY OF SEATAC, WASHINGTON
RIVERTON HEIGHTS PARK IMPROVEMENTS
BID BOND

BOND NO._____
AMOUNT $_____

KNOW ALL PERSONS BY THESE PRESENTS

that_____as Principal,

hereinafter called the Contractor, and_____ a

corporation duly organized under the laws of the State of _____ having its

principal place of business at_____ in the State of _____ and authorized to do business in State of Washington, as SURETY, are held and firmly bound unto the City of SeaTac as OBLIGEE, hereinafter called the Owner, in the penal sum of
_____

Dollars ($_____) for the payment of which Contractor and Surety bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND IS SUCH THAT: WHEREAS the Contractor is herewith submitting a Bid Proposal for the above referenced project. Project and said Bid Proposal, by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, if the said Bid Proposal submitted by the Contractor is accepted and the Contract awarded to the Contractor and if the Contractor shall execute the proposed Contract and shall furnish the Public Works Performance Bond and labor and Material Payment Bond as required by the Bidding and Contract Documents within the time fixed by said Contract Documents, then this obligation shall be void; if the Contractor shall fail to execute the proposed Contract and furnish the required bond, the SURETY hereby agrees to pay to the Owner the penal sum as liquidated damages.

In the event suit is brought upon this bond by said OBLIGEE and judgment is recovered, said SURETY shall pay all costs incurred by said OBLIGEE in such suit, including a reasonable attorney's fee to be fixed by the court.

Signed and sealed this _____ day of_____, 2026.

_____ _____

CONTRACTOR	SURETY
By _____	By_____
	ATTORNEY-IN-FACT

The Attorney-in-Fact who executes this bond in behalf of the SURETY must attach a copy of his power of attorney as evidence of his authority.

SECTION 00420
STATEMENT OF BIDDER'S QUALIFICATIONS

Name of Contractor.....

Address: .....

.....

Phone Number: ..... Fax : .....

Washington State Department of Labor and Industries Workmen's Compensation Account No.:

.....

Washington State Department of Licenses Contractor's Registration

No.....

Expiration Date: .....

Number of years the contractor has been engaged in the construction business under the present firm name indicated:.....

Gross dollar amount of work under contract: .....

Gross dollar amount of contracts not completed: .....

Type of work generally performed by contractor: .....

.....

List of five public projects of a similar nature which have been completed by the contractor within the last five years and the gross dollar amount of each project:

Bid Project Name	Agency	Contact & Phone No.	Year Completed	Amount

List of major pieces of equipment which are owned by the Contractor and which will be available and required for use on this project:

.....

.....

.....

.....

.....

.....

Bank References:.....

.....

Have you changed bonding companies within the last three years.....

If so, why? (Optional): .....

.....

Have you ever sued or been sued by the client on any public works contract for a special district, municipality, county, or

state government? .....

Who? .....

For what reason: .....

.....

.....

Disposition of case, if settled: .....

.....

Name of Superintendent to be used on the project and how long with your company: .....

.....

Bidder: .....
(Printed Name of Bidder)

By: .....
(Signature of Authorized Official)

Title: .....

SECTION 00430
SUBCONTRACTOR LIST

Instructions:

1) This form must be submitted on all projects where the Owner's estimate of the project cost (Engineer's estimate) exceed $1,000,000 including additive alternates.
2) Pursuant to RCW 39.30.060, list the names of the subcontractors with whom the bidder, if awarded the contract, will subcontract for performance of the work of: HVAC (heating, ventilation, and air conditioning); plumbing as described in chapter 18.106 RCW; and electrical as described in chapter 19.28 RCW, or to name itself for the work. The prime contract bidder shall not list more than one subcontractor for each category of work identified, unless subcontractors vary with bid alternates, in which case the prime contract bidder must indicate which subcontractor will be used for which alternate. Failure of the prime contract bidder to submit as part of the bid the names of such subcontractors or to name itself to perform such work or the naming of two or more subcontractors to perform the same work shall render the prime contract bidder's bid nonresponsive and, therefore, void.
3) This form must be submitted within one hour of the advertised bid due date/time, regardless of subcontractor usage.
4) This form must bear the bidder's signature to be considered complete.
5) Failure to properly complete and submit this form may result in a bid being declared non-responsive.

BASE BID

Name of Subcontractor	Designated Work	Estimated Subcontract Amount
HVAC		
PLUMBING		
ELECTICAL		
OTHER		
OTHER		

_____ _____
Bidder's Signature Bidder's Name (Printed)

_____ _____
Company Date

Debarment, Suspension, Ineligibility or Voluntary Exclusion Certification Form

NAME		Doing business as (DBA)	
ADDRESS	**Project Number (if any):**	WA Uniform Business Identifier (UBI)	Federal Employer Tax Identification #:
This certification is submitted as part of a request to contract.			

Instructions For Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions

READ CAREFULLY BEFORE SIGNING THE CERTIFICATION. Federal regulations require contractors and bidders to sign and abide by the terms of this certification, without modification, in order to participate in certain transactions directly or indirectly involving federal funds.

1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the department, institution, or office to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or had become erroneous by reason of changed circumstances.
4. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meaning set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under the applicable CFR, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled ``Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under applicable CFR, debarred, suspended, ineligible, or voluntarily excluded from covered transactions, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant should, but is not required to, check the List of Parties Excluded from Federal Procurement and Non-procurement Programs.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business activity.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under applicable CFR, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions

The prospective lower tier participant certifies, by submission of this proposal or contract, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this form.

Bidder or Contractor Signature:_____ Date: _____

Print Name and Title: _____

FEDERAL DEBARMENT, SUSPENSION INELIGIBILITY and VOLUNTARY EXCLUSION

(FREQUENTLY ASKED QUESTIONS)

What is "Debarment, Suspension, Ineligibility, and Voluntary Exclusion"?
These terms refer to the status of a person or company that cannot contract with or receive grants from a federal agency.

In order to be debarred, suspended, ineligible, or voluntarily excluded, you must have:

- Had a contract or grant with a federal agency, and
- Gone through some process where the federal agency notified or attempted to notify you that you could not contract with the federal agency.
- Generally, this process occurs where you, the contractor, are not qualified or are not adequately performing under a contract, or have violated a regulation or law pertaining to the contract.

Why am I required to sign this certification?
You are requesting a contract with the City of SeaTac, referred to as the "City". Federal law (Executive Order 12549) requires the City ensure that persons or companies that contract with the City are not prohibited from having federal contracts.

What is Executive Order 12549?
Executive Order 12549 refers to Federal Executive Order Number 12549. The executive order was signed by the President and directed federal agencies to ensure that federal agencies, and any state or other agency receiving federal funds were not contracting or awarding grants to persons, organizations, or companies who have been excluded from participating in federal contracts or grants. Federal agencies have codified this requirement in their individual agency Code of Federal Regulations (CFRs).

What is the purpose of this certification?
The purpose of the certification is for you to tell the City in writing that you have not been prohibited by federal agencies from entering into a federal contract.

What does the word "proposal" mean when referred to in this certification?
Proposal means a solicited or unsolicited bid, application, request, invitation to consider or similar communication from you to the City.

What or who is a "lower tier participant"?
Lower tier participants means a person or organization that submits a proposal, enters into contracts with, or receives a grant from the City, OR any subcontractor of a contract with the City. If you hire subcontractors, you shall require them to sign a certification and keep it with your subcontract.

What is a covered transaction when referred to in this certification?
Covered Transaction means a contract, oral or written agreement, grant, or any other arrangement where you contract with or receive money from the City. Covered Transaction does not include mandatory entitlements and individual benefits.

Sample Debarment, Suspension, Ineligibility, Voluntary Exclusion Contract Provision

Debarment Certification. The Contractor certifies that the Contractor is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in this Contract by any Federal department or agency. If requested by the City, the Contractor shall complete a Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion form. Any such form completed by the Contractor for this Contract shall be incorporated into this Contract by reference.

SECTION 00460
CERTIFICATION OF NON-SEGREGATED FACILITIES

The Bidder certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The bidder agrees that a breach of this certification will be a violation of the Equal Opportunity clause in any contract resulting from acceptance of this bid. As used in this certification the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The bidder agrees that (except where he has obtained identical certification from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

Note: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001

Date_____, 2026.

(Name of Bidder)

_____

Official Address:

By:_____ _____

(Signature) (Print or Type Name)

_____

(Title)

*MUST ACCOMPANY EACH BID WITHOUT ALTERATION

END OF SECTION

SECTION 00481
NON-COLLUSION AFFIDAVIT

_____, being first duly sworn, on his oath says that the bid submitted, is a genuine and not a sham of collusive bid, or made in the interest or on behalf of any person therein named; and he further says that the bidder has not directly or indirectly induced or solicited any bidder on the above work or supplies to put in a sham bid, or any person or corporation to refrain from bidding; and that said bidder has not in any manner sought by collusion to secure an advantage over any other bidder or bidders.

_____
CONTRACTOR

Subscribed and sworn to before me this _____ day of _____, 2026.

_____

NOTARY PUBLIC in and for the State of Washington

residing at_____.

My commission expires_____.

SECTION 00 04 85
10% SUBCONTRACTOR LIST

List each subcontractor, from any tier of subcontractors, that shall perform subcontract work amounting to more than 10% of the total bid contract price. List each bid item to be performed by each designated subcontractor in numerical sequence. **If no subcontractors will be performing 10% or more of the work, indicate this by writing "None" and signing this form at the bottom of the page.** Failure to submit a fully completed and signed subcontractor list after the time set for bid opening may disqualify your bid.

Project Name: _____

Project Number: _____

Subcontractor Name
Item Numbers

Subcontractor Name
Item Numbers

Subcontractor Name
Item Numbers

Subcontractor Name
Item Numbers

Subcontractor Name
Item Numbers

CONTRACTOR'S SIGNATURE_____

END OF SECTION

PUBLIC WORKS AGREEMENT

between City of SeaTac AND CONTRACTOR NAME.
for
RIVERTON HEIGHTS PARK IMPROVEMENTS

THIS AGREEMENT is made by and between the City of SeaTac, a Washington municipal corporation (hereinafter the "City"), and CONTRACTOR organized under the laws of the State of Washington, located and doing business at CONTRACTOR ADDRESS (hereinafter the "Contractor").

AGREEMENT

The parties agree as follows:

I. DESCRIPTION OF WORK.

Contractor shall perform the following services for the City in accordance with the following described plans and/or specifications:

PROJECT DESCRIPTION
The work of the Riverton Heights Park Improvements project includes, but is not limited to providing all labor, materials, tools, equipment, and incidentals necessary to install a complete and operating new spray park, a prefabricated restroom/mechanical building, new utilities, new pathways, a new, turfed play field, new fencing, new lighting, plantings, irrigation systems and installing public sculpture and other work described in construction documents.

Contractor further represents that the services furnished under this Agreement will be performed in accordance with generally accepted professional practices within the Puget Sound region in effect at the time such services are performed.

II. TIME OF COMPLETION. It is agreed that the work covered by this Agreement shall commence as soon as the Contractor has been officially notified to proceed (Notice to Proceed). The Contractor shall complete the work of each Work Order within 274 calendar days.

This Agreement shall be in effect for _____ from the date of execution unless terminated otherwise in accordance with its provisions. The City reserves the right to extend the Agreement for _____ year with a written Change Order.

III. COMPENSATION. The City shall pay the Contractor a total amount not to exceed $Contract Amount plus any applicable Washington State Sales Tax, for the work and services contemplated in this Agreement. The Contractor shall invoice the City upon project completion. The City will pay for the portion of the work described in the invoice that has been completed by

the Contractor and approved by the City. The City's payment shall not constitute a waiver of the City's right to final inspection and acceptance of the project.

A. Performance Bond. Pursuant to Chapter 39.08 RCW, the Contractor, shall provide the City a performance bond for the full contract amount to be in effect until sixty (60) days after the date of final acceptance, or until receipt of all necessary releases from the State Department of Revenue and the State Department of Labor and Industries and until settlement of any liens filed under Chapter 60.28 RCW, whichever is later.

B. Retainage. The City shall hold back a retainage in the amount of five percent (5%) of any and all payments made to contractor for a period of sixty (60) days after the date of final acceptance, or until receipt of all necessary releases from the State Department of Revenue and the State Department of Labor & Industries and until settlement of any liens filed under Chapter 60.28 RCW, whichever is later. The amount retained shall be placed in a fund by the City pursuant to RCW 60.28.011(4)(a), unless otherwise instructed by the Contractor within fourteen (14) calendar days of Contractor's signature on the Agreement.

C. Defective or Unauthorized Work. The City reserves its right to withhold payment from Contractor for any defective or unauthorized work. Defective or unauthorized work includes, without limitation: work and materials that do not conform to the requirements of this Agreement; and extra work and materials furnished without the City's written approval. If Contractor is unable, for any reason, to satisfactorily complete any portion of the work, the City may complete the work by contract or otherwise, and Contractor shall be liable to the City for any additional costs incurred by the City. "Additional costs" shall mean all reasonable costs, including legal costs and attorney fees, incurred by the City beyond the maximum Contract price specified above. The City further reserves its right to deduct the cost to complete the Contract work, including any Additional Costs, from any and all amounts due or to become due the Contractor.

C. Final Payment: Waiver of Claims. THE CONTRACTOR'S ACCEPTANCE OF FINAL PAYMENT (EXCLUDING WITHHELD RETAINAGE) SHALL CONSTITUTE A WAIVER OF CONTRACTOR'S CLAIMS, EXCEPT THOSE PREVIOUSLY AND PROPERLY MADE AND IDENTIFIED BY CONTRACTOR AS UNSETTLED AT THE TIME FINAL PAYMENT IS MADE AND ACCEPTED.

IV. INDEPENDENT CONTRACTOR. The parties intend that an Independent Contractor-Employer Relationship will be created by this Agreement and that the Contractor has the ability to control and direct the performance and details of its work, the City being interested only in the results obtained under this Agreement.

V. TERMINATION. The City may terminate this Agreement for good cause. "Good cause" shall include, without limitation, any one or more of the following events:

A. The Contractor's refusal or failure to supply a sufficient number of properly skilled workers or proper materials for completion of the Contract work.

B. The Contractor's failure to complete the work within the time specified in this Agreement.

C. The Contractor's failure to make full and prompt payment to subcontractors or for material or labor.

D. The Contractor's persistent disregard of federal, state or local laws, rules or regulations.

E. The Contractor's filing for bankruptcy or becoming adjudged bankrupt.

F. The Contractor's breach of any portion of this Agreement.

If the City terminates this Agreement for good cause, the Contractor shall not receive any further money due under this Agreement until the Contract work is completed. After termination, the City may take possession of all records and data within the Contractor's possession pertaining to this project which may be used by the City without restriction.

VI. PREVAILING WAGES. Contractor shall file a "Statement of Intent to Pay Prevailing Wages," with the State of Washington Department of Labor & Industries prior to commencing the Contract work. Contractor shall pay prevailing wages in effect on the date the bid is accepted or executed by Contractor and comply with Chapter 39.12 of the Revised Code of Washington, as well as any other applicable prevailing wage rate provisions. A copy of the applicable wage rates is available for viewing in our office. A hard copy of the applicable wage rates will be mailed upon request.

VII. CHANGES. The City may issue a written change order for any change in the Contract work during the performance of this Agreement. If the Contractor determines, for any reason, that a change order is necessary, Contractor must submit a written change order request to the person listed in the notice provision section of this Agreement, section XV(D), within fourteen (14) calendar days of the date Contractor knew or should have known of the facts and events giving rise to the requested change. If the City determines that the change increases or decreases the Contractor's costs or time for performance, the City will make an equitable adjustment. The City will attempt, in good faith, to reach agreement with the Contractor on all equitable adjustments. However, if the parties are unable to agree, the City will determine the equitable adjustment as it deems appropriate. The Contractor shall proceed with the change order work upon receiving either a written change order from the City or an oral order from the City

before actually receiving the written change order. If the Contractor fails to require a change order within the time specified in this paragraph, the Contractor waives its right to make any claim or submit subsequent change order requests for that portion of the contract work. If the Contractor disagrees with the equitable adjustment, the Contractor must complete the change order work; however, the Contractor may elect to protest the adjustment as provided in subsections A through E of Section VIII, Claims, below.

The Contractor accepts all requirements of a change order by: (1) endorsing it, (2) writing a separate acceptance, or (3) not protesting in the way this section provides. A change order that is accepted by Contractor as provided in this section shall constitute full payment and final settlement of all claims for contract time and for direct, indirect and consequential costs, including costs of delays related to any work, either covered or affected by the change.

VIII. CLAIMS. If the Contractor disagrees with anything required by a change order, another written order, or an oral order from the City, including any direction, instruction, interpretation, or determination by the City, the Contractor may file a claim as provided in this section. The Contractor shall give written notice to the City of all claims within fourteen (14) calendar days of the occurrence of the events giving rise to the claims, or within fourteen (14) calendar days of the date the Contractor knew or should have known of the facts or events giving rise to the claim, whichever occurs first. Any claim for damages, additional payment for any reason, or extension of time, whether under this Agreement or otherwise, shall be conclusively deemed to have been waived by the Contractor unless a timely written claim is made in strict accordance with the applicable provisions of this Agreement.

At a minimum, the Contractor's written claim shall include the information set forth in subsections A, items 1 through 5 below.

FAILURE TO PROVIDE A COMPLETE, WRITTEN NOTIFICATION OF CLAIM WITHIN THE TIME ALLOWED SHALL BE AN ABSOLUTE WAIVER OF ANY CLAIMS ARISING IN ANY WAY FROM THE FACTS OR EVENTS SURROUNDING THAT CLAIM OR CAUSED BY THAT DELAY.

A. Notice of Claim. Provide a signed written notice of claim that provides the following information:

1. The date of the Contractor's claim;
2. The nature and circumstances that caused the claim;
3. The provisions in this Agreement that support the claim;
4. The estimated dollar cost, if any, of the claimed work and how that estimate was determined; and
5. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption.

B. Records. The Contractor shall keep complete records of extra costs and time incurred as a result of the asserted events giving rise to the claim. The City shall have access to any of the Contractor's records needed for evaluating the protest.

The City will evaluate all claims, provided the procedures in this section are followed. If the City determines that a claim is valid, the City will adjust payment for work or time by an equitable adjustment. No adjustment will be made for an invalid protest.

C. Contractor's Duty to Complete Protested Work. In spite of any claim, the Contractor shall proceed promptly to provide the goods, materials and services required by the City under this Agreement.

D. Failure to Protest Constitutes Waiver. By not protesting as this section provides, the Contractor also waives any additional entitlement and accepts from the City any written or oral order (including directions, instructions, interpretations, and determination).

E. Failure to Follow Procedures Constitutes Waiver. By failing to follow the procedures of this section, the Contractor completely waives any claims for protested work and accepts from the City any written or oral order (including directions, instructions, interpretations, and determination).

IX. LIMITATION OF ACTIONS. CONTRACTOR MUST, IN ANY EVENT, FILE ANY LAWSUIT ARISING FROM OR CONNECTED WITH THIS AGREEMENT WITHIN 120 CALENDAR DAYS FROM THE DATE THE CONTRACT WORK IS COMPLETE OR CONTRACTOR'S ABILITY TO FILE THAT CLAIM OR SUIT SHALL BE FOREVER BARRED. THIS SECTION FURTHER LIMITS ANY APPLICABLE STATUTORY LIMITATIONS PERIOD.

X. This section intentionally left blank.

XI. DISCRIMINATION. In the hiring of employees for the performance of work under this Agreement or any sub-contract, the Contractor, its sub-contractors, or any person acting on behalf of the Contractor or sub-contractor shall not, by reason of race, religion, color, sex, age, sexual orientation, national origin, or the presence of any sensory, mental, or physical disability, discriminate against any person who is qualified and available to perform the work to which the employment relates.

XII. INDEMNIFICATION. Contractor shall defend, indemnify and hold the City, its officers, officials, employees, agents and volunteers harmless from any and all claims, injuries, damages, losses or suits, including all legal costs and attorney fees, arising out of or in connection with the Contractor's performance of this Agreement, except for that portion of the injuries and

damages caused by the City's sole negligence.

The City's inspection or acceptance of any of Contractor's work when completed shall not be grounds to avoid any of these covenants of indemnification.

Should a court of competent jurisdiction determine that this Agreement is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Contractor and the City, its officers, officials, employees, agents and volunteers, the Contractor's liability hereunder shall be only to the extent of the Contractor's negligence.

IT IS FURTHER SPECIFICALLY AND EXPRESSLY UNDERSTOOD THAT THE INDEMNIFICATION PROVIDED HEREIN CONSTITUTES THE CONTRACTOR'S WAIVER OF IMMUNITY UNDER INDUSTRIAL INSURANCE, TITLE 51 RCW, SOLELY FOR THE PURPOSES OF THIS INDEMNIFICATION. THE PARTIES FURTHER ACKNOWLEDGE THAT THEY HAVE MUTUALLY NEGOTIATED THIS WAIVER.

The provisions of this section shall survive the expiration or termination of this Agreement.

XIII. INSURANCE. The Contractor shall procure and maintain insurance as outlined below for the duration of this Agreement. Any Commercial General Liability and Automobile Liability insurance policies obtained shall be underwritten by insurance companies which have an A.M. Best's rating of A VII or better, licensed to do business in the State of Washington. Liability insurance policies shall specifically name the City, its elected or appointed officials, officers, employees and volunteers as *Primary-Non-Contributory Additional Insureds* of said policies.

The Contractor shall not begin work under the Agreement until all required insurance has been obtained and until such insurances have been received by the City. The Contractor shall file with the City a certificate of insurance evidencing that the policies are in force. The certificate shall be accompanied by policy endorsements as are necessary to comply with these requirements.

The types and limits insurance are as follows:

COMMERCIAL GENERAL LIABILITY-Comprehensive Form
$5,000,000 aggregate.
Coverage to include Premise and Operations Liability
Blanket Contractual
OCP for subcontractors' liability
Product and Completed Operations Liability
Stop Gap Liability-$1,000,000/$1,000,000/$1,000,000
Primary-Non-Contributory Additional Insured coverage for the City et.al.

AUTOMOBILE LIABILITY
$2,000,000 per accident bodily injury and property damage liability, including any owned, hired or non-owned automobile.

WORKER'S COMPENSATION
Employees of Contractor and Subcontractors are to be insured under Washington State Industrial Insurance.

The General Aggregate provision of the Contractor's insurance policies shall be amended to show that the General Aggregate Limit of the policies applies separately to this contract.

Failure of the Contractor to fully comply with the requirements regarding insurance will be considered a material breach of contract and shall be cause for immediate termination of the contract.

XIV. WORK PERFORMED AT CONTRACTOR'S RISK. Contractor shall take all necessary precautions and shall be responsible for the safety of its employees, agents, and subcontractors in the performance of the contract work and shall utilize all protection necessary for that purpose. All work shall be done at Contractor's own risk, and Contractor shall be responsible for any loss of or damage to materials, tools, or other articles used or held for use in connection with the work.

The Contractor shall also be solely and completely responsible for safety and safety conditions on the job site, including the safety of all persons and property during performance of the work. The services of City employees or the engineer's personnel in conducting construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's work methods, equipment, bracing, scaffolding or trenching, or safety measures in, on or near the construction site. The Contractor shall provide safe access for the City and its inspectors to adequately inspect the quality of work and the conformance with project specifications.

XV. MISCELLANEOUS PROVISIONS.

A. Recyclable Materials. The City recommends that its contractors and consultants use recycled and recyclable products whenever practicable.

B. Non-Waiver of Breach. The failure of the City to insist upon strict performance of any of the covenants and agreements contained in this Agreement, or to exercise any option conferred by this Agreement in one or more instances shall not be construed to be a waiver or relinquishment of those covenants, agreements or options, and the same shall be and remain in full force and effect.

C. Resolution of Disputes and Governing Law. This Agreement shall be governed by

and construed in accordance with the laws of the State of Washington. If the parties are unable to settle any dispute, difference or claim arising from the parties' performance of this Agreement, the exclusive means of resolving that dispute, difference or claim, shall only be by filing suit exclusively under the venue, rules and jurisdiction of the King County Superior Court, King County, Washington, Maleng Regional Justice Center, unless the parties agree in writing to an alternative dispute resolution process. In any claim or lawsuit for damages arising from the parties' performance of this Agreement, the prevailing party shall recover its attorney's fees and costs incurred in bringing or defending such claim or lawsuit, including all appeals, in addition to any other recovery or award provided by law. Nothing in this paragraph shall be construed to limit the City's right to indemnification under Section XII of this Agreement.

D. Liquidated Damages. The parties agree that the City will suffer damage and be put to additional expense if the Contractor does not have the work completed in all respects and ready for use on or prior to the completion dates agreed upon. As it is difficult to accurately compute the amount of such costs and damages, the Contractor agrees to pay to the City as liquidated damages in the amount of Two Hundred and Fifty Dollars ($250.00) for each day the Contractor is required to achieve Substantial Completion of the work beyond the period above fixed. It is hereby agreed that the above amount shall be deducted from payment due the Contractor or from any sums retained for benefit of the Contractor's employees, subcontractors or suppliers.

E. Written Notice. All communications regarding this Agreement shall be sent to the parties at the addresses listed on the signature page of the Agreement, unless notified to the contrary. Any written notice hereunder shall become effective three (3) business days after the date of mailing by registered or certified mail, and shall be deemed sufficiently given if sent to the addressee at the address stated in this Agreement or such other address as may be hereafter specified in writing.

F. Assignment. Any assignment of this Agreement by either party without the written consent of the non-assigning party shall be void. If the non-assigning party gives its consent to any assignment, the terms of this Agreement shall continue in full force and effect and no further assignment shall be made without additional written consent.

G. Modification. No waiver, alteration, or modification of any of the provisions of this Agreement shall be binding unless in writing and signed by a duly authorized representative of the City and Contractor.

H. Entire Agreement. The written provisions and terms of this Agreement, together with any Exhibits attached hereto, shall supersede all prior verbal statements of any officer or other representative of the City, and such statements shall not be effective or be construed as entering into or forming a part of or altering in any manner this Agreement. All of the above documents are hereby made a part of this Agreement. However, should any language in any of the Exhibits to this Agreement conflict with any language contained in this Agreement, the terms

of this Agreement shall prevail.

I. Compliance with Laws. The Contractor agrees to comply with all federal, state, and municipal laws, rules, and regulations that are now effective or in the future become applicable to Contractor's business, equipment, and personnel engaged in operations covered by this Agreement or accruing out of the performance of those operations.

J. Counterparts. This Agreement may be executed in any number of counterparts, each of which shall constitute an original, and all of which will together constitute this one Agreement.

IN WITNESS, the parties below execute this Agreement, which shall become effective on the last date entered below.

CONTRACTOR:	CITY OF SEATAC:
By:_____ *(signature)* Print Name:_____ Its_____ *(title)* DATE:_____	By:_____ *(signature)* Print Name: Jonathan Young Its: City Manager DATE:_____
NOTICES TO BE SENT TO: CONTRACTOR: Contact Name Business Name Business Address City, State Zip Phone (telephone)	NOTICES TO BE SENT TO: CITY OF SEATAC: Clynn Wilkinson City of SeaTac 4800 South 188th Street SeaTac, WA 98188 (206) 973-4755 (telephone) cwilkinson@seatacwa.gov
	Approved as to Form: By:_____ *(signature)*

SECTION 00600
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that_____

of _____ as Principal, and

_____ as Surety, are

jointly and severally held and bound unto the City of SeaTac in the sum of

_____ Dollars ($_____.____), for payment of which we jointly and severally bind ourselves, our heirs, executors, administrators and assigns, and successors and assigns, firmly by these presents.

THE CONDITION of this bond such that, the Principal herein made and entered into a certain contract with the City of SeaTac, for the above referenced project for work items, which contract consists of the Proposal/Agreement, together with the Contract Documents, Standard Specifications, Special Provisions, Addenda and Plans, all as attached and made part hereof.

Now, therefore, if the Principal shall well, truly and faithfully perform all of the provisions and fulfill all of the undertakings, covenants, terms, conditions, and agreements of said Contract during the period of the original contract, and any extension thereof that may be granted by the City of SeaTac, with or without notice to the Surety, and during the life of any guarantee required under the Contract and shall also well and truly perform and fulfill all of the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived; and furthermore, shall pay all laborers, mechanics and subcontractors and material suppliers and all persons who shall supply such person or persons, and such Principal or subcontractors with the provisions and supplies for the carrying on of such work, shall indemnify and save harmless the City of SeaTac from all cost and damage by reason of the Principal's default or failure to do so and shall pay the State of Washington sales and use taxes and the amounts due said state pursuant to Titles 50 and 51 of the Revised Code of Washington, and shall further indemnify the workmanship or materials entering into any part of the work as defined in the agreement, to remain in full force and effect; provided, that the provisions of this bond shall not apply to any money loaned or advanced to the Principal or any subcontractor or other person in the performance of any such work.

Signed and dated this _____ day of _____, 2026.

PRINCIPAL:

By:_____
Signature

SURETY:

By:_____
Signature

_____	_____
Print or Type Name	Print or Type Name
Title: _____	Title: _____
Address: _____	Address: _____

Note: If attorney-in-fact signs for surety, a certified copy of the power of attorney must be attached.

SECTION 00700
RETAINED PERCENTAGE

CITY OF SEATAC, WASHINGTON
DECLARATION OF OPTION FOR MANAGEMENT OF
STATUTORY RETAINED PERCENTAGE

A. I hereby elect to have the retained percentage of this contract held in a fund by the City of SeaTac until thirty (30) days following final acceptance of the work.

Signed _____

Date _____

==========

B. I hereby elect to have the City of SeaTac invest the retained percentage of this contract from time to time as such retained percentage accrues and in accordance with RCW 60.28.0l0, .020, and .050.

I hereby designate _____ as the repository for the escrow of said funds.

Branch of repository:_____

Address:_____

Contact:_____ Phone No.:_____

Account No.:_____

I hereby further agree to be fully responsible for payment of all costs or fees incurred as a result of placing said retained percentage in escrow and investing it as authorized by statute.

The City of SeaTac shall not be liable in any way for any costs or fees in connection therewith.

Signed _____

Date _____

SECTION 00800
GENERAL CONDITIONS

1.01 REFERENCED STANDARD

A. AIA document A201, “General Conditions of the Contract for Construction”, 2017 edition are by reference made a part of this contract as though fully set forth herein. A copy of the document may be reviewed at the City Clerk's office of the City of SeaTac:

SeaTac City Hall
4800 S 188th St
SeaTac, WA 98188

or a copy may be purchased at AIA Seattle located at 1911 First Avenue, Seattle, WA 98101.

B. Where any condition of AIA Document A201 is contradicted or modified by any other provision of Division 0 or Division 1 of these contract documents the Division 0 or Division 1 provision will govern. Where any article, paragraph, or subparagraph or parts of an article paragraph or subparagraph of AIA document A201 is contradicted, modified or voided by provisions of Division 0 or Division 1 the portions of such provisions not so effected shall remain in effect.

END OF SECTION

SECTION 00850
SUPPLEMENTARY GENERAL CONDITIONS

1.01 GENERAL

A. The following additions, deletions and modifications to the General Conditions supersede applicable articles and paragraphs of the standard form AIA Document A201.

1.02 ARTICLE 1, GENERAL PROVISIONS

A. Subparagraph 1.1.7 add the following: “Anything mentioned in the specifications and not shown on the drawings or shown on the drawings and not mentioned in the specifications shall be of like effect as if mentioned or shown on both. In case of difference between small and large-scale drawings, the large-scale drawing shall govern. Schedules on any drawing shall take precedence over conflicting information on that or any other contract drawing. On any of the drawings where a portion of the work is detailed or drawn out and the remainder is shown in outline, the parts detailed or drawn out shall apply also to all other like portions of the work.”

1.03 ARTICLE 3, CONTRACTOR

A. SUBPARAGRAPH 3.6.1: Add the following sentence: “The Washington State and Local Sales Taxes, if applicable, will be reimbursed to the Contractor by Owner.”

B. PARAGRAPH 3.10.4: Add the following paragraph: “The Contractor’s Construction Schedule shall not be construed to alter the terms of the Contract as it pertains to Contract Completion Time, Delays and Time Extensions.”

C. PARAGRAPH 3.11.1: Change to read: “The Contractor shall keep the building record set of Contract Documents at the job during construction in good condition. They shall be kept up to date daily and shall include approved shop drawings, and other modifications. Just prior to final acceptance, the Contractor shall deliver to the Architect the approved set of plans showing all modifications 'as-built'. ”

1.04 ARTICLE 4, ARCHITECT

A. PARAGRAPH 4.2.3: Change the second sentence to read: “. . . not be responsible for the Contractor’s or his Surety’s failure to carry out. . .”

B. PARAGRAPH 4.2.11: Delete first sentence and in lieu, insert the following:
“The Architect will provide opinions to the Owner regarding interpretations of the requirements of the Contract Documents and the performance there under by the Contractor. The architect will not be liable for result of his opinion rendered in good faith.”

C. PARAGRAPH 4.2.11: Delete second sentence and in lieu, insert the following:

"The Owner will within a reasonable time, render decisions regarding interpretations through the architect as he may deem necessary for the proper execution or progress of the work. The decisions will be in writing or in the form of drawings and within any time limits agreed upon."

D. PARAGRAPH 4.2.12 Delete.

1.05 ARTICLE 7, CHANGES IN THE WORK

A. PARAGRAPH 7.3.6: Add the following:

7.3.6 Overhead and profit shall be calculated as described in Section 01015, Special Provisions.

1.06 ARTICLE 8, TIME

A. Add the following under 8.1 Definitions:

8.1.5 The Contractor has been delayed only when the Contractor's completion of the work has been caused to be extended beyond the Contract Completion Time by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate Contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor'' control, or by delay authorized by the Owner pending arbitration, or by other causes which the Architect and Owner determine may justify work delay.

1.07 ARTICLE 9, PAYMENTS AND COMPLETION

A. SUBPARAGRAPH 9.4.1: Change to read: ". . . within ten days after. . ."

B. SUBPARAGRAPH 9.5.1: Delete and in lieu, add the following:

".3 failure of the Contractor to present affidavit performing to proper and timely payments to subcontractors or for labor materials or equipment. . ."

C. Add the following subparagraph:

9.6.7 As duly certified by Architect, Owner will make partial payment to the Contractor, but the Owner shall retain a sum equal to (5%) of each payment as retainage. Retainage will be held until project closeout as described in Section 01700.

D. PARAGRAPH 9.7.1: Change first sentence to read:

". . .within ten days after receipt of. . .to pay Contractor with ten days after. . ."

1.08 ARTICLE 11, INSURANCE AND BONDS

A. Add the following: "Contractor shall secure Public Liability and Property Damage Insurance Coverage in the minimum amount of $1,000,000 combined single limit from an insurance company authorized to do business in the State of Washington. Said insurance coverage may be superseded by addenda or other provisions of this Contract. CITY shall be an additional named insured on said insurance in a form acceptable to the City Attorney.

1.09 ARTICLE 13, MISCELLANEOUS PROVISIONS

A. PARAGRAPH 13.4.1: Change to read: ". . .not a limitation of any duties, obligations, defenses, rights and remedies. . ."

1.10 ARTICLE 14, TERMINIATION OF THE CONTRACT

A. PARAGRAPH 14.2.2: Change to read: ". . .Contractor and his Surety, if any, ten days written notice. . ." and add the following after the last sentence: "In the event of any such termination, the Owner shall serve notice thereof upon the Surety and the Contractor, and the Surety shall have the right to take over and perform the Contract; provided, however, that if the Surety does not commence performance thereof within ten days from the date of the mailing to such Surety of notice of termination, the Owner may take over the Work and prosecute the same to completion by contract or by force for the account and at the expense of the Contractor, and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned by the Owner thereby, and in such event the Owner may take possession of and utilize in completing the Work, such materials, appliances, and plant as may be on the site of the Work and necessary therefore."

END OF SECTION

SECTION 00900
STATE REQUIREMENTS

The Contractor must submit a Statement of Intent to Pay Prevailing Wages on City contracts, as per the current State of Washington Department of Labor and Industries, Form SF 9882.

When a difference exists between wage rates for a particular craft, the higher of the two required wage rates shall apply.

A list of the hourly prevailing wage rates is incorporated in and made part of the Contract Documents.

END OF SECTION

SECTION 01110
SUMMARY OF WORK

PART 1 — GENERAL

1.1 SUMMARY

A. Section includes:
1. Project information
2. Contact award and time of completion
3. Work covered by contract documents
4. Work under separate contracts
5. Future work
6. Owner-furnished contractor installed products
7. Access to site
8. Work restrictions
9. Specification and drawing conventions
10. Use of site by Owner
11. Applicable standards
12. Existing soils

B. Related Section:
1. Division 1, Section 01500 – Temporary Facilities for limitations and procedures governing temporary use of Owner's facilities.

C. This Section applies to all Specification Sections and supplements to the General and Supplemental Conditions.

1.2 PROJECT INFORMATION

A. Project Identification: RIVERTON HEIGHTS PARK IMPROVEMENTS
1. Project Location: 3011 S 148th Street, SeaTac, WA 98188. Refer to plan sheet G0.1 for project site vicinity map.

B. Owner: City of SeaTac. 4800 South 188th Street, SeaTac, WA 98188.
1. Owner's Representative: Clynn Wilkinson; Phone (206) 973-4755; Email: cwilkinson@seatacwa.gov

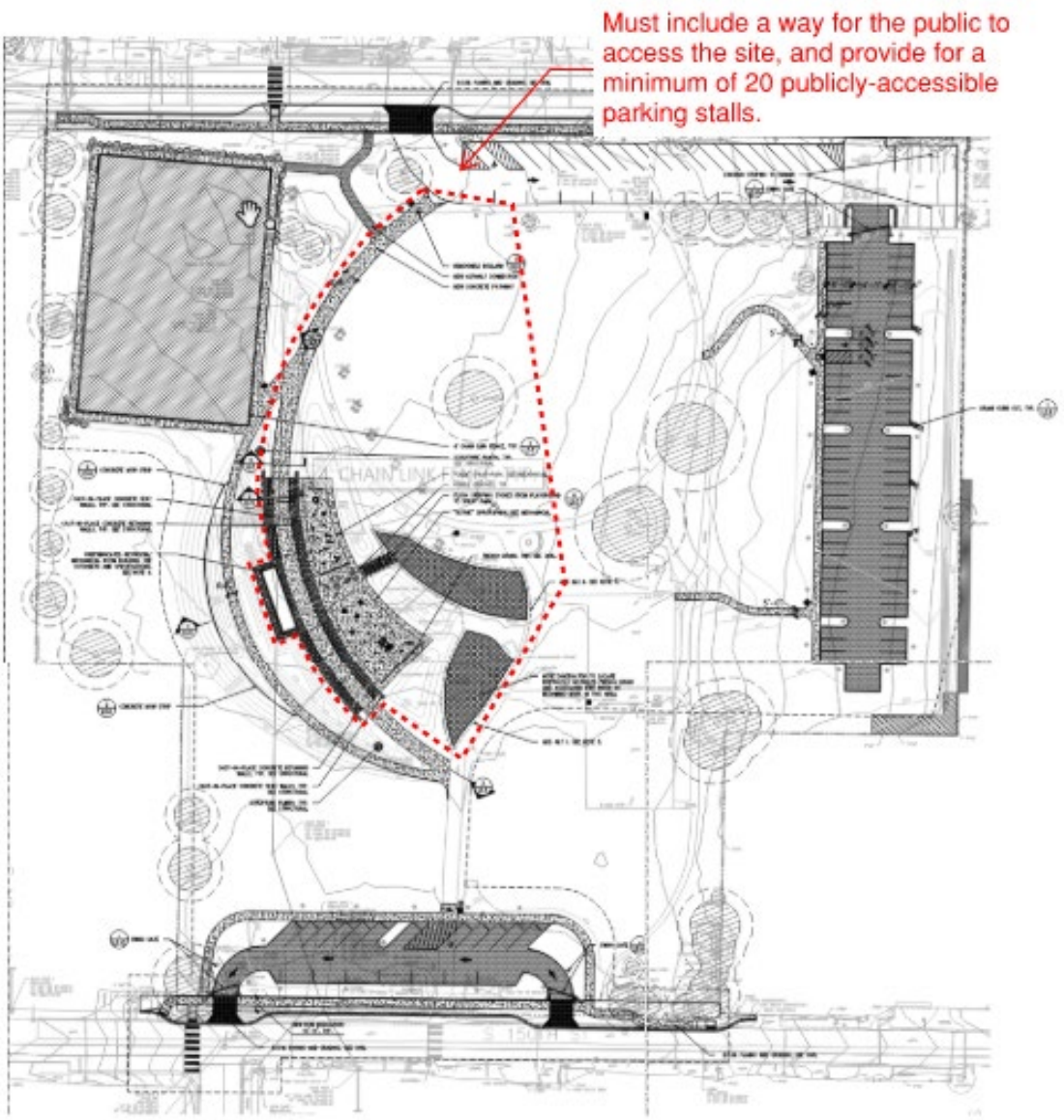
C. Landscape Architect: MxM Landscape Architecture, LLC. 922 25th Ave S, Seattle, WA 98144.
1. Principal-in-Charge: Brice Maryman; Phone (206) 310-7254; Email: brice@mxmla.com

1.3 CONTRACT AWARD AND TIME OF COMPLETION

A. Single Contract Award: it is the Owner's intent to award a single prime contract for the improvements.

B. Time of Completion: 274 Calendar days.
   1. Notice of Award: October 8
   2. Construction Start: October 8
   3. Substantial Completion: July 9, 2027
   4. Final Acceptance: July 16. 2027

C. Incentives for early completion: It is of utmost importance to the City of SeaTac that the spray park and restroom be open, functional, and inspected/approved by Seattle/King County Public Health (SKCPH) as early as possible so that the community can enjoy it.
   1. Extent of improvements that need to be constructed include:



2. If the contractor is able to complete the spray park such that it is ready for SKCPH inspection by the following dates, the following monetary incentives apply. These costs may be realized by the contractor as profit above and beyond any other profit built into the regular bid.

By Memorial Day 2027	$50,000
By June 15	$25,000
By June 30	$10,000

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and generally consists of the following:
   1. The work of the Riverton Heights Park Improvements project includes, but is not limited to providing all labor, materials, tools, equipment, and incidentals necessary to install a complete and operating new spray park, a prefabricated restroom/mechanical building, new utilities, new pathways, a new, turfed play field, new fencing, new lighting, plantings, irrigation systems and installing public sculpture and other work described in construction documents.

B. Type of Contract:
   1. Project will be constructed under a single prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

A. Not applicable.

1.6 FUTURE WORK

A. The Contract Documents include requirements that will allow the Owner to carry out future work following completion of this project.

1.7 OWNER-FURNISHED PRODUCTS

A. Products and equipment will be furnished by the Owner.

B. Items include, but are not limited to, the following:
   1. Restroom/Spray Park mechanical room. Contractor to install prefabricated building structure on Contractor constructed foundations per Contract Documents, and install all necessary utility connections.
   2. Litter receptacles. Owner to install.

1.8 ACCESS TO SITE

A. General: Access to the site must be kept open at all times for emergency vehicle use.
   1. Site access and construction access shall be agreed upon award.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
   2. Noise Restrictions: Conform to City of SeaTac residential neighborhood noise ordinances.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 6 p.m., Monday through Friday, except as otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than five (5) days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Nonsmoking Site: Smoking is not permitted within any Park property.

E. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall", "shall be", or "shall comply with", depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 1 General Requirements: Requirements of Sections in Division 1 of these specifications apply to the Work of all Sections in these Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the specifications. One or more of the following are used on the Drawings to identify materials and products:
   1. Terminology: materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

1.11 USE OF SITE BY OWNER

A. Riverton Heights Park will be closed to the public during construction.

B. The Contractor is responsible for securing the site at the conclusion of each work day.

1.12 APPLICABLE STANDARDS

A. Prior to commencing construction, Contractor shall contact all reviewing agencies, utility companies, and governmental agencies having jurisdiction over the Project site, and obtain all standards and requirements for work that will satisfy those requirements, including purchasing necessary construction permits and being placed on any and all "approved contractors" lists.

1.13 EXISTING SOILS

A. The Contractor shall visit the site prior to bidding to familiarize oneself with the site and soil conditions. Bidders may coordinate with the Owner to excavate their own test holes.

B. It shall be the Contractor's sole responsibility, prior to bidding, to determine what soil conditions may be encountered. Investigation of the soil condition and associated costs by the Contractor shall be considered included in the bid price(s).

C. See Appendix for test pit locations and logs.

PART 2 — PRODUCTS

Not used.

PART 3 — EXECUTION

Not used.

END OF SECTION

SECTION 01230
PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Bidders shall submit a proposal for the base bid and alternates. The Owner reserves the right to award the base bid only if considered to be in the Owner's best interest. Only basic information concerning Base Bid and Alternates is listed in the proposal. No attempt has been made to list all items or details. Refer to technical sections of the Specifications and Plans for detailed information.

1.2 MEASUREMENT AND PAYMENT

Not used.

1.3 METHOD OF AWARD – LOWEST QUALIFIED BIDDER

A. It is the intent of the Owner to award the Contract to the Contractor submitting the lowest bid within the funds available for work included in the Base Bid and any alternates selected in any order.

1.4 SITE WORK

A. Base Bid:
   1. Includes all labor, materials, equipment, and incidentals required for completion of the work drawn and specified, together with the necessary appurtenant work.
   2. Work not included in the Base Bid: Work noted as "Not in Contract," abbreviated N.I.C., or work included under Alternates is not included in the Base Bid.

B. Alternates: Additive alternate bids shall include work described in the proposal and shall include modifications, adjustments, and revisions to the Base Bid or other work necessary to incorporate such alternate work into the project. The sum shown on the Contractor's Proposal shall cover all costs or credits of the work affected by such alternate work to integrate the alternate work into the completed project.

ADDITIVE ALTERNATE A –

Includes:

- Tile resilient surfacing for existing play area.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01300
ADMINISTRATIVE PROCEDURES

PART 1 — GENERAL

1.1 CONDITIONS OF CONTRACT

A. Contractor shall familiarize themselves thoroughly with all conditions of the specifications, as well as technical sections.

1.2 CONTRACT DOCUMENTS FOR CONSTRUCTION

A. Construction sets of project documents shall be paid for by the Contractor.

1.3 PERMITS

A. The Owner will obtain and pay for site development, public health, building and city permits, and stormwater permit. The Contractor shall obtain and pay for any other permits.

NOTE: Responsibility for all work and associated costs thereof shall become that of the Contractor with the Notice to Proceed.

B. The Contractor shall notify the Owner and coordinate with the permitting authority for extension of all permits that expire prior to final acceptance. The Owner will be responsible for permit fees and/or related extension costs for the Owner furnished permits only.

C. The Contractor shall comply with the requirements / conditions of the permits.
   1. Site development permit requirements
   2. NPDES requirements
   3. Storm connections
   4. Building
   5. Seattle/King County Public Health Aquatics Permit
   6. Electrical
   7. Plumbing

1.4 PROJECT SIGN

A. Type: Provide a 4' x 8' x ¾" plywood sign mounted on two (2) 10' long x 6" x 6" posts.

B. Copy:
   1. Project Name
   2. Owners

3. Contractor
4. Landscape Architect
5. Graphic of site (architect will furnish to contractor)

C. Color: Black letters with white background.

D. Provide shop drawing with copy for approval prior to fabrication.

E. Locate sign where directed by Owner.

1.5 OTHER SIGNS

A. No signs of contractor, subcontractor, or advertising of any kind are to be erected.

1.6 PROTECTION OF MATERIALS

A. The Contractor is responsible for protection of materials and completed work from damage, replacement, or theft until the work is accepted.

1.7 DUST CONTROL

A. The Contractor shall be responsible for alleviation or prevention of any dust nuisance arising from the work on this project, by the use of water or dust palliatives as required and as approved by the Owner.

1.8 VANDALISM

A. The Contractor is hereby advised to take all lawful and prudent precautions against vandalism on any work and equipment connected with this project. The Owner will not in any way be held responsible or accountable for vandalism, either financially or be responsible to repair or replace.

1.9 WEATHER

A. Each bidder shall satisfy himself before submitting his bid to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any U.S. Weather Bureau Office. No additional payment will be made for any conditions caused by inclement weather.

1.10 EROSION CONTROL

A. The Contractor shall be responsible at all times for erosion control during construction and for repair of any completed work damaged by erosion - until final acceptance.

1.11 MAINTENANCE OF STREETS, UTILITIES, ETC.

A. The Contractor shall be responsible at all times for the maintenance of streets and other utilities affected by construction operations. Streets and utilities shall be kept in full operation during the entire course of the project. Debris and rubbish shall not be permitted to accumulate, and all premises shall be maintained in a neat and workman-like condition, as determined by the Owner.

B. In the event the Contractor fails to conform to these requirements, the Owner shall have the right to have the work done by others and the cost will be deducted from monies due the Contractor.

1.12 STATE LICENSING LAW

A. The Contractor agrees and covenants to furnish the Owner proper evidence that the Contractor has fully complied with the State Licensing Law as specified in Chapter 18.27 of the Revised Code of Washington (RCW), as amended; and a Contractor's Certificate of Registration shall be in full force and effect throughout the work project hereinabove enumerated. The Contractor shall include his Contractor's license number on the space provided in the Proposal Form.

1.13 EXISTING SITE TOPOGRAPHY

A. The existing topography is shown as contour lines and spot elevations as indicated in the legend on the topographic survey plans. Notify Owner immediately should actual conditions vary significantly from those shown.

1.14 SURVEY DATA/EXISTING CONDITIONS

A. The Contractor's licensed surveyor shall establish and stake out control points and all coordinate points provided for the various parts of the work for location, lines, and grades from the base line as shown on the plans. An electronic file of the layout and grading drawings will be provided to the surveyor upon request.

1.15 PROJECT RECORD DRAWINGS AND SPECIFICATIONS

A. The Contractor shall keep one (1) set of drawings and specifications at the site for the purpose of recording all changes made during construction as changes occur. All changes shall be noted with date and signature of Contractor on the drawings as changes occur.

B. In addition, the drawings and specifications shall be marked to record all materials used where options or alternates were indicated or specified and dimensional changes made during the course to the work shall be drawn to scale.

C. A record drawing shall be prepared and stamped by a licensed surveyor reflecting the actual vertical and horizontal locations of the storm drainage, constructed on the project site. The record drawings shall include the following declaration by the licensed surveyor. "WE HEREBY DECLARE THAT THE STORM DRAINAGE IMPROVEMENTS ARE LOCATED AS SHOWN ON THESE RECORD DRAWINGS PER THE FIELD MEASUREMENTS TAKEN ON _____."

1.16 LIQUIDATED DAMAGES

A. See the General Conditions of the contract.

1.17 ARTIFACTS

A. Should 'artifacts' of historical significance (i.e. Native Americans) be unearthed, stop work and notify the Owner or their Representative immediately.

1.18 TOBACCO PRODUCTS, DRUGS, AND ALCOHOL

A. Tobacco products, drugs, and alcohol are strictly prohibited on the property, inside and outside of buildings.

PART 2 — PRODUCTS

Not used.

PART 3 — EXECUTION

Not used.

END OF SECTION

SECTION 01310
PROJECT MANAGEMENT & COORDINATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination with work by the Owner.

B. Coordination.

C. Field engineering.

D. Pre-construction conference.

E. Progress meetings.

F. Pre-installation conferences.

1.2 COORDINATION WITH WORK BY THE OWNER

A. See Section 011100, 1.7.

1.3 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure proper, efficient, and orderly sequence of surface preparation and installation of interdependent construction elements, with provisions for accommodating items installed later by Owner.

B. Coordinate completion and cleanup of Work of separate sections in preparation for Completion.

C. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 FIELD ENGINEERING

A. See Section 01300, 1.14.

1.5 PRE-CONSTRUCTION CONFERENCE

A. Owner will schedule a conference after Notice of Award.

B. Attendance Required: Owner, Owner's Representative, and Contractor.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties in Contract, and the Owner's Representative.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.
8. Coordination with Owner.
9. Notice to Proceed.

1.6 PROGRESS MEETINGS

A. Owner will schedule and administer meetings throughout progress of the work at weekly intervals.

B. Contractor shall attend meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Owner's Representative, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of submittals and status of submittals.
3. Review of RFIs (Requests for Information and Status)
4. Review of schedule and maintenance of schedule.
5. Review plans and specifications related to anticipated work.
6. Review of Work progress. Field observations, problems, and decisions.
7. Other business relating to Work.

1.7 PRE-INSTALLATION CONFERENCES

A. When required in individual specification Section, convene a pre-installation conference at work site prior to commencing work of this Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Owner seven (7) days in advance of meeting date.

D. Prepare agenda, preside at conference.

E. Review conditions of installation, preparation, and installation procedures, and coordination with related work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01330
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.
B. Construction progress schedules.
C. Subcontractor's list.
D. Shop drawings.
E. Product data.
F. Samples.
G. Manufacturer's instructions.
H. Manufacturer's certificates.

1.2 SUBMITTAL PROCEDURES

A. A list of required submittal items will be provided by the Owner's representative following award of the contract. Transmit each submittal item with a separate transmittal form included in these specifications.

B. Each required submittal item will be numbered. Transmit electronically each submittal to the architect with a transmittal form.

C. Identify Project, Contractor, Subcontractor, or Supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Product required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents. This shall be done prior to submitting to Owner's Representative.

E. Schedule submittals to expedite the Project, and deliver to Owner's Representative. Coordinate submission of related items. Note: Allow three (3) weeks for the Owner's Representative to review the submittals from the date they receive the submittal.

F. Identify the appropriate specification section title and number to which the submittal applies, as well as variations from Contract Documents and Product or system limitation that may be detrimental to successful performance of the completed work.

G. Provide space for Contractor and Owner's Representative review stamps.

H. Revise and resubmit submittals as required, identifying all changes made since previous submittal.

I. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule within 5 days after date of Owner-Contractor Agreement, for Owner's Representative information.

B. Revise and resubmit monthly (with each pay request). Post 1 on site.

C. Three week look ahead at each progress meeting.

D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically-grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

E. Indicate estimated percentage of completion for each item of Work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, pre-installation meeting and product delivery dates, including those furnished by Owner and under Allowances.

G. If the Contractor submits a schedule which indicates a construction completion date prior to the advertised contract completion date, it is understood that the Owner shall not be obligated for any costs associated with any extensions of the contractor's schedule which is still within the stipulated contract completion period. No contract time extension shall be granted until the contractor demonstrates that the Critical Path is directly impacted, and the construction completion date must be extended past the stipulated contract completion date.

1.4 SUBCONTRACTOR'S LIST

A. Within 5 days after date of Owner-Contractor Agreement, submit complete list of subcontractors and major material suppliers with addresses and telephone numbers. Use form included in these specifications.

1.5 SHOP DRAWINGS

A. Submit the number of copies that the contractor requires, plus three (3) copies that will be retained by the Owner, if hard copies only are provided.

B. After review, reproduce and distribute in accordance with Article on Procedures above and for Record Documents described in Section 01770 – Closeout Procedures.

1.6 PRODUCT DATA

A. Submit the number of copies that the Contractor requires, plus three (3) copies that will be retained by the Owner.

B. Mark each copy to identify applicable specification section title and number, products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01770 – Closeout Procedures.

1.7 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Submit samples of finishes from the full range of manufacturers' standard colors and custom colors selected, textures, and patterns for Owner’s Representative’s selection.

C. Include identification on each sample, with full Project information.

D. Submit the number or samples specified in individual specification Sections; one of which will be retained by the Owner’s Representative.

E. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

F. Deliver samples to the office of the Owner's Representative with transmittal. No samples will be accepted on-site.

1.8 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.9 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturer's certificate to Owner’s Representative for review, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Owner’s Representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01330
SUBMITTAL TRANSMITTAL

Project: RIVERTON HEIGHTS PARK IMPROVEMENTS Date: _____

A/E Project Number: _____

Transmittal A

To: (Consultant)
Address
City, State, Zip

Submittal Number: _____

From: (Contractor)
Address
City, State, Zip

By:

☐ Resubmission

(One Item per Transmittal)

Qty.	Item No.	Description	Spec. Section Title and Paragraph / Drawing Detail Reference

☐ Submitted for review and approval

☐ Resubmitted for review and approval

☐ Will be available to meet construction schedule

☐ Other remarks on above submission:

☐ Substitution involved – Substitution request attached with point-by-point comparative data or preliminary details.

☐ Complies with contract requirements

☐ One copy retained by sender

Transmittal B

To: (Contractor)

Attn:

Date Received by A/E:

From: (Consultant)

By:

Date Transmitted by A/E:

☐ Approved

☐ Approved as noted / Resubmit

☐ Approved as noted

☐ Rejected / Resubmit

☐ Not subject to review

☐ Revise / Resubmit

☐ No action required

☐ Submission Incomplete / Resubmit

☐ Other remarks on above submission:

Copies: ☐ Owner ☐ Consultants ☐ ☐ ☐ ☐ One copy retained by sender

SUBCONTRACTORS

Project: RIVERTON HEIGHTS PARK IMPROVEMENTS From (Contractor): _____

To: _____ Date: _____

_____ A/E Project Number: ____

_____ Contract For: _____

List Subcontractors and Major Material Suppliers proposed for use on this Project as required by the Construction Documents. Attach supplemental sheets if necessary.

Section Number	Section Title	Firm	Address	Phone Number	Contact	E-Mail Address

☐ Attachments

Signed by: _____ Date: _____

Copies: ☐ Owner ☐ Consultants ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ File

SECTION 01330
MAJOR MATERIAL SUPPLIERS

Project: RIVERTON HEIGHTS PARK IMPROVEMENTS From (Contractor): _____

To: _____ Date: _____

_____ A/E Project Number: ____

_____ Contract For: _____

List Subcontractors and Major Material Suppliers proposed for use on this Project as required by the Construction Documents. Attach supplemental sheets if necessary.

Section Number	Section Title	Firm	Address	Phone Number	Contact	E-Mail Address

☐ Attachments

Signed by: _____ Date: _____

Copies: ☐ Owner ☐ Consultants ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ File

SECTION 01400
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality Assurance/Control of Installation.

B. References.

C. Inspection and Testing Laboratory Services.

1.2 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturer's instructions, including each step in sequence.

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Owner’s Representative before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 REFERENCES

A. Conform to reference standard by date of issue current on date for receiving bids.

B. Should specified reference standards conflict with Contract Documents, request clarification from Owner’s Representative before proceeding.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 INSPECTION AND TESTING LABORATORY SERVICES

A. Owner will appoint, employ, and pay for services of an independent firm to perform inspection and testing of subgrade and crushed rock, concrete, and asphalt, and other work requested by the Owner.

B. That independent firm will perform inspections, tests, and other services except those specifically required of the Contractor in individual specification Sections.

C. Reports will be submitted by the independent firm to the Owner's Representative and Owner indicating observations and results of tests and indicating compliance or noncompliance with Contract Documents.

D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.

E. Notify Owner's Representative and independent firm 24 hours prior to expected time for operations requiring service.

F. Make arrangements with independent firm and pay for additional samples and tests beyond the Owner's use required for Contractor's use.

G. Re-testing and site visits required because of nonconformance to specified requirements and scheduling shall be performed by the same independent firm on instructions by the Owner's Representative. Payment for redesign and site visits will be charged by the Owner to the Contractor by deducting inspection or testing charges from the Contract Sum/Price.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01420
REFERENCES

PART 1 - GENERAL

1.1 NUMBER OF SPECIFIED ITEMS REQUIRED

A. Wherever these specifications, an article, device, or piece of equipment is referred to in the singular number, such reference applies to all and as many such articles as are shown on the drawings, or required to complete the installation.

1.2 DEFINITIONS

A. *Owner:* City of SeaTac.

B. *Owner's Representative (Landscape Architect)*: an employee of or consultant to the City of SeaTac.

C. *Provide*: 'furnish and install' or 'furnish labor and materials required for installation, ready for use, and under the terms of the contract drawings'.

D. *'As shown'*, *'as indicated'*, *'as detailed'*, *'as noted'*, or words of similar meaning refer to contract drawings.

E. *The work* : The work to be accomplished under this contract.

F. *Approved*: Approved by the owner or designated authority.

G. *For approval:* For owner approval, or designated authority.

H. Where the words *'or equal'* are used, the Owner is the sole judge of the quality and suitability of the proposed substitution.

I. *Products:* 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. Products may also include existing materials or components required for reuse.

1.3 ABBREVIATIONS

A. See Legends on the drawings.

1.4 ORGANIZATION OF SPECIFICATIONS

A. Divisions and sections of these specifications conform generally to customary trade practice. They are intended for convenience only. The Owner and Owner's Representative are not bound to define the limits of any subcontract.

1.5 DIMENSIONS AND MEASUREMENTS

A. Dimensions govern. Do not scale drawings, unless so indicated on the plans. Check all dimensions in the field and verify them with respect to the adjacent or incorporated work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 CONTRACTOR'S WORK

A. All work specified under this Section shall be provided by the Contractor.

1.2 TEMPORARY POWER

A. Contractor to provide sufficient electric power of capacity necessary and make it available to all those connected with the work. The Contractor is to pay for all temporary transformers, lines, poles, meters, and other changes and all charges connected with the use of the permanent facilities until accepted by the Owner. All costs and other charges in providing electric power to be paid by Contractor until acceptance of the project by the Owner.

1.3 COMMUNICATIONS

A. Provide a list of and contact information for all key personnel.

1.4 TEMPORARY DRINKING WATER

A. Make necessary arrangements and provide drinking water from a proven safe source required during entire construction period. Comply with state and local health requirements. Serve in single service containers or sanitary drinking fountain.

1.5 WATER FOR CONSTRUCTION

A. Contractor to provide water and make it available to all those connected with the work. Obtain a temporary hydrant permit if required--if any hydrants are used. Water used to construct the site shall be metered and paid by the contractor.

1.6 TEMPORARY SANITARY FACILITIES

A. Provide adequate toilet facilities for all those connected with work. Locate inside the construction area and keep in sanitary condition. Remove when directed by Owner and disinfect premises.

1.7 TEMPORARY SHEDS

A. Construct and maintain such temporary sheds as may be required for the use of workmen, for tool cribs, and for the storage of materials, project plans and documents.

B. Provide temporary light in all areas of the sheds. All sheds shall be maintained at all times in good repair and in a clean and sanitary condition. Upon completion of the work, all sheds shall be removed and the premises cleaned.

1.8 STAGING AREA

A. The Contractor staging area to be agreed upon by the Contractor and the Owner. Submit a proposed location to the Owner for approval. All disturbed areas shall be cleaned up, fine graded, seeded, and otherwise restored to its original condition as determined by the Owner.

1.9 FIELD OFFICE

A. Meetings with the Owner and Owner's Representative will be held onsite. In the event of inclement weather, the Owner will schedule use of a meeting room at the SeaTac Community Center located at 13735 24th Avenue

1.10 DAILY CLEAN UP

A. (See General Conditions.)

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 015639
TREE, PLANT, AND SOIL PROTECTION

Part 1 - GENERAL

1.1 SUMMARY

A. This section includes general protection of existing trees, plants and soils that are affected by execution of the Work, whether temporary or permanent construction.

1. Protection and care for existing trees to be preserved;
2. Protection and care for existing trees to be transplanted;
3. Installation and maintenance of tree protection fencing and soil protection fencing;
4. Identification of branches and major limbs of trees to be preserved that need to be pruned for construction clearance and/or other reason;
5. Pruning and maintenance of trees to be preserved per direction from City of SeaTac Arborist;
6. Prevention of the use of motorized and heavy equipment within CRZ and storage within the CRZ;
7. Controlling surface runoff and erosion; and
8. Coordination with the Temporary Erosion and Sedimentation Control (TESC) plan.

1.2 PURPOSE

A. Existing trees are a critical element of the environment. Mature trees provide a greater amount of biomass than newly planted trees, contributing to shading of pavements and improving air and water quality. Large trees are part of a site's and neighborhood's history and character. Protection, care and maintenance is required as part of construction activities and permit requirements of this Project.

1.3 RELATED SECTIONS

A. Coordinate with related Work specified in other parts of the Project Manual.

B. Coordinate with the General Conditions and Supplemental Conditions in the Contract.

1.4 REFERENCES, ABBREVIATIONS AND DEFINITIONS

A. Reference the following standards

1. ISA International Society of Arboriculture

B. Diameter at breast height (DBH): diameter of a trunk as measured at a height 54 inches above the ground line.

C. Critical Root Zone (CRZ): The critical root zone is an area for an individual tree and is defined as the area beneath the crown dripline unless noted otherwise.

D. Drip line: Per survey and Contract Documents.

E. Tree Care and Maintenance: Providing a provision for and the "act" of maintaining a tree's condition and or restoring a tree from a stressed condition.

F. Tree, Vegetation and Soil Protection Plan (TVSPP): The TVSPP is a document prepared by City of SeaTac Arborist which describes the way approved work is to be performed within the CRZ of trees to be preserved. The TVSPP also summarizes the Authority Having Jurisdiction (AHJ) requirements as well as describes and outlines tree maintenance procedures to be followed during the term of this Contract.

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

1.5 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference a minimum of 10 days before work begins, Contracting Officer, Contractor, Inspector and City of SeaTac's Arborist. City Arborist will define requirements in the preinstallation conference or in a follow up meeting to the preinstallation conference. The City Arborist will then be available for all other references requiring an arborist's input defined in the specifications.

1.6 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of the following:

1. Mulch: 1-gallon volume of arborist wood chip mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Arborist Wood Chip Mulch gradation
3. Protection Zone Fencing: Cut Sheet.
4. Protection Zone Signage:

    a. Full-size samples of each size and text, ready for installation per Contract Documents.

B. Tree, Vegetation and Soil Protection Plan (TVSPP) to be provided at pre-con by City of SeaTac Arborist:

1. Include Contract Documents and locations of protection fencing and signage.

2. Indicate extent of trenching by hand or with air spade within protection zones.
3. Include watering, care and maintenance methods and schedule
4. Plan shall address project work areas which are inside and adjacent to project limits. Include staging, access, laydown, storage areas and areas that will remain undisturbed.
5. Plan shall be correlated to Project Schedule and intended sequencing.
6. Quality-control program.

C. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed and dated photographs of existing conditions of trees within and within 50' of the approximate limits of work shown in the Plans.
2. Photographs to include minimum of one (1) photo of a full view and one (1) photo of each trunk root flare zone.
3. Include Contract Documents and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.2 QUALITY CONTROL

A. Quality Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include the instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.3 FIELD CONDITIONS

A. The following practices are prohibited within CRZ:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Non-manual excavation unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

Part 2 - PRODUCTS

2.1 MULCH

A. Tree Protection Mulch: Arborist Wood Chip Mulch as follows:

1. Quality: Arborist Wood Chip Mulch (AWCM) shall be coarse ground wood chips (approximately 1/2" to 4" along the longest dimension) derived from the mechanical grinding or shredding of the above-ground portions of trees. It may contain lumber, manufactured wood products, wood fiber, bark and branches; but may not contain leaves or visible amounts of soil. It shall be free of weeds and weed seeds Including but not limited to plants on the King County Noxious Weed list available at: https://kingcounty.gov/en/dept/dnrp/nature-recreation/environment-ecology-conservation/noxious-weeds/identification-control/noxious-weeds-list, and shall be free of invasive plant portions capable of resprouting, including but not limited to horsetail, ivy, clematis, knotweed, etc. It may not contain more than ½% by weight of manufactured inert material (plastic, concrete, ceramics, metal, etc.).
2. Do not contaminate mulch with invasive plants, plastic, metal, toxic materials, or other non-biodegradable material.
3. Chipped material from onsite trees that have been removed is acceptable as long as it is free of invasive plants such as ivy, blackberry, etc.
4. Gradation. AWCM, when tested, shall meet the following loose volume gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
2"	95	100
1"	70	100
5/8"	0	50
1/4"	0	40

2.2 FENCING

A. Soil and Tree Protection Zone Fencing: Fencing shall meet the following requirements for noted application:

1. Chain-Link Protection Zone Fencing for Tree Protection Zone:

a. Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch-OD line posts, and 2-7/8-inch- OD corner and pull posts; with 1-5/8-inch- OD top and bottom rails; with tie wires, hog ring ties, and other accessories for a complete fence system.

1) Height: 72 inches.
2) Concrete pier blocks to have a minimum weight of 75 pounds.
3) Pier Block Anchors: #4 rebar
4) Chain link fence panel clamp: galvanized steel
5) Otherwise approved modular steel construction fencing.

2. Plastic Protection Zone Fencing for Soil Protection Zone:

a. Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with nylon zip ties or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts, 2-inch by 2-inch wood posts or rebar with protective caps, spaced not more than 48 inches apart.
1) Height: 48 inches.
2) Color: High-visibility orange, non-fading.

B. Protection zone fencing for soil protection shall consist of chain-link fencing when associated with tree protection and plastic protection zone fencing when associated with plant, lawn or topsoil protection, future stormwater areas (i.e. rain garden, porous pavement, dispersal trench).

C. Jute Netting shall be constructed on 100% biodegradable jute fibers. Thickness shall be between 3 to 6MM.

2.3 SIGNAGE

A. Tree Protection Zone Signage

1. Protect Tree Value Signage: Shop-fabricated, rigid plastic, metal sheet, or other material that is weather resistant for at least one year with attachment holes pre-punched and reinforced; legibly printed with non-fading lettering and as follows:

a. Lettering: 3-inch-high minimum
b. Sign Size: approximately 14 inches by 20 inches
c. Each sign to read: “Keep Out: Soil & Vegetation Protection Area”

B. GEOCOIR DeKoWe 400 fabric or approved equal.

Part 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion and sedimentation control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch to 2-inch wide blue plastic tape around each tree trunk at 54 inches above the ground and securely around shrubs and other vegetation to remain. Review trees with Inspector.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree Protection Zones: Arborist wood chip mulch areas inside tree-protection zones and other areas indicated. Thickness of mulch shall be maintained within 1" of depth indicated on contract documents.

1. If area is to remain lawn, do not apply mulch.
2. Prior to placing mulch, apply tree root protection jute netting.
3. Apply 4-inch thickness of organic mulch unless otherwise indicated. Do not place protection fabric or mulch within 2 feet of tree trunks.

3.3 PROTECTION ZONES

A. Tree Protection Zone Fencing: Install protection zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe 4-foot minimum clear passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or near street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts:

    a. Set posts into concrete pier blocks. Secure every other pier block with rebar bent over block with both ends embedded per plan into the ground.
    b. If existing topography or features (stairs, walls, rockeries) prevents use of concrete pier blocks, fence posts can be driven into the ground as approved by City's Arborist. Set or drive posts into ground one-third the total height of the fence within landscape areas.

3. Access Point: Install one access point per fence; adjust to open smoothly, easily, and quietly. Each access point to be secured with chain link fence panel clamp.
4. Attach 1-inch to 2-inch wide orange plastic tape strips 12 inches long at 3-feet on-center spacing along the tree protection zone fence, 5-feet above grade.
5. An alternate fence type may be submitted for consideration and written approval.

B. Protection Zone Fencing: Install protection zone fencing along edges of plant and soil protection zones in a manner that will prevent people and animals from easily entering protected areas before materials or equipment are brought on the site and construction operations begin. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Take care not to damage existing plants or compact existing soil when installing fencing. Install posts a minimum of 1-foot deep at approximately 4-feet on center, attach fence fabric to posts a minimum of 3 places. Stretch fabric uniformly between posts.
2. Fencing is not required where vegetation is protected by an existing fence or tree protection zone fencing.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection zone fencing and signage in good condition as acceptable to Owner's Representative.

1. Do not remove protection zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by City's Arborist if a root buffer effective against soil compaction is installed as directed by City's Arborist. Maintain root buffer so long as access is permitted.

E. To minimize grading within the CRZ, paths are constructed on top of existing grade where feasible. Feather edge of parks into existing grades using compacted topsoil, allowing for a 1' flat shelf at the edge of the path. Grade topsoil at a maximum 3:1 slope. Mulch topsoil.

F. Protect and maintain vegetation that protects soil areas to remain. Protected soil areas are indicated as undisturbed and/or as future stormwater/LID facilities on Contract Documents.

3.4 ROOT PRUNING

A. Root Pruning within CRZ: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

B. Prune tree roots that are affected by temporary and permanent construction. Prune roots as directed by City's Arborist. At a minimum:

1. Notify Inspector and City's Arborist when roots greater than 2" shall be required to be cut from trees.
2. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
3. Cut Ends: Do not paint cut root ends.
4. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
5. Cover exposed roots with burlap and water regularly.
6. Backfill as soon as possible according to requirements in Section 31 00 00 Earthwork.

3.5 DIGGING FOR TRANSPLANTING

A. Trees with 6 in. or less caliper shall be moved with a minimum 60 in. mechanical tree spade.

B. Trees between 6 and 10 in. caliper shall be moved with a minimum 90 in. mechanical tree spade.

C. Trees larger than 10 in. caliper shall be moved with equipment of a larger size approved by the Engineer.

D. In the event a tree spade cannot be utilized, the Contractor shall request written approval from the Engineer to relocate tree by hand digging. Trees hand dug shall have rootballs generally circular, with a minimum diameter of 5 ft. and a minimum depth of 3 ft.

E. The Contractor may "heel in" the transplanted trees for storage during site construction within a stockpile of topsoil.

1. Healed in trees must be covered in mulch and watered until ready to be transplanted to their final location on site as shown in the contract documents.

F. The Contractor shall be responsible for locating all underground utilities for transplant operation.

G. The Contractor shall be responsible for watering and maintaining the trees for the duration of the contract.

H. The Contractor shall keep the project area cleaned of all debris and shall maintain it in a neat and presentable condition for the duration of the contract. The Contractor shall fill, grade, and repair any damaged work areas on the project site, and shall exercise utmost care to prevent damage to any utilities, structures, existing plant material, or other facilities on the site.

3.6 PRUNING.

A. Before digging, remove limbs within 24 in. of the soil line. Prune any limbs that may interfere with the operation of the tree spade. Prune in accordance with the National Arborist Association Class I Pruning Standards.

1. Remove cross-branches and branches that detract from the normal shape of the tree.
2. Remove all dead wood.

B. Pruners and pruning saws shall be kept sharp, clean and properly adjusted to ensure proper cuts. Anvil type pruners or loppers will not be acceptable pruning equipment.

3.7 DIGGING, TRANSPORTING, AND PLANTING TREES TO BE TRANSPLANTED

A. Trees shall be centered in the machine when dug. Caution should be observed to prevent damage to the tree branches and trunks while backing onto or driving away from the tree.

B. Roots protruding from the digging spades shall be cut flush with the rootball before planting.

C. Trucks transporting trees shall be equipped with automatic transmissions.

D. Trees shall be dug and transplanted within 48 hours.

3.8 CROWN PRUNING

A. Refer to City's Arborist for questions regarding pruning of branches that are affected by temporary and permanent construction.

3.9 EXCAVATION

A. General:

1. Excavate at edge of protection zones according to requirements in Section 31 00 00 Earthwork unless otherwise indicated.
2. Excavation within CRZ to be under the supervision of the City's Arborist.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots less than two-inches that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.10 REGRADING WITHIN CRZ

A. Root Pruning: Prune small (under 2-inch) tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots without written approval of City's Arborist.

B. Raising Grade: Where new finished grade is indicated above existing grade around trees, feather back to existing grade with maximum 3:1 slope.

3.11 FIELD QUALITY CONTROL

A. Inspections: The City's Arborist shall direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain.

3.12 MAINTENANCE

A. At existing trees, re-apply mulch where deficient to retain 4-inch depth. Verify that mulch is no closer than 24 inches to the trunk of the tree. Remove and dispose of excess mulch.

B. Maintain existing grass and landscaping within the protection zone if specified to remain.

C. Remove weeds within the dripline of the CRZ by hand, a minimum of once a month to prevent weed overgrowth during the course of construction. If weeding within the CRZ is not being completed, the Owner's Representative may, at their discretion, contract the work to be performed and deduct via Change Order the invoiced amount from the Contract.

D. Mow lawn within tree protection areas a minimum of once a month during growing season.

3.13 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs indicated to remain or to be transplanted that are damaged by construction operations, in a manner approved by Inspector.

1. Submit documentation of proposed repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to City Arborist written instructions.
3. Replace shrubs and other plants that cannot be repaired and restored to full-growth status, as determined by Inspector. See below for tree repair and replacement.

B. Impacted Trees: Remove trees indicated to remain that are more than 35 percent dead or in an unhealthy condition before the end of final punchlist or that are damaged during construction operations that Inspector determines are incapable of restoring to normal growth pattern. Provide the following compensation:

1. Replace impacted trees at a 3:1 ratio. Replaced trees must be a minimum of 2" caliper.

C. Soil Aeration: Where directed by Inspector and City's Arborist, aerate surface soil compacted during construction. Aerate from 10 feet beyond drip line to no closer than 4 feet to tree trunk flare. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off City of SeaTac Parks property.

3.15 CLOSEOUT

A. Maintain tree and vegetation protection fencing to remain six (6) months minimum after project closeout. Removal to be approved or directed by Owner's Representative.

END OF SECTION

SECTION 01600
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Requirements.

1.3 PRODUCTS

A. Products: Means 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. Products may also include existing materials or components required for reuse.

B. Provide interchangeable components of the same manufacturer, for similar components.

1.4 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, disfigurements, or damage.

1.5 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. For exterior storage of fabricated products, place on sloped supports, above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or descriptions.

B. Products Specified by Naming One or More Manufacturers with or without a Provision for Substitutions: Submit a request for substitution for any manufacturer not named, unless "No Substitution" is noted.

1.7 SUBSTITUTIONS

A. The Owner’s representative will consider requests for Substitutions up to 10 days prior to bid opening date. Approved Substitutions will be listed on Addenda.

B. Substitutions may be considered after bid opening only when a Product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that the Bidder/Contractor:
   1. Has investigated proposed substitution Product and determined that it meets or exceeds the quality level of the specified Product.

2. Will provide the same warranty for the substitution as for the specified Product.
3. Will coordinate installation and make changes to other work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals.

F. Substitution Submittal Procedure:
1. All substitution requests shall be accompanied with the Substitution Request Form, completely filled out. Substitution Request Forms are found in the Specifications in Section 01630.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01630
PRODUCT SUBSTITUTION REQUEST

TO: MxM Landscape Architecture
922 25th Ave S
Seattle, WA 98144

PROJECT NAME: RIVERTON HEIGHTS PARK IMPROVEMENTS

CONTRACTOR:

We hereby submit for consideration the following product instead of specified item for above project:

SectionParagraph	Specified Item
_____	_____

Proposed Substitution: _____

Attach complete dimensional information and technical data, including laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications, which proposed substitution will require for its proper installation.

Submit with request all necessary samples and substantiating data to prove equal quality, performance, and appearance to that which is specified. Clearly mark manufacturer's literature to indicate equality performance. Differences in quality of materials and construction shall be indicated.

Fill in blanks below:

A. Reason for substitution request:
_____
_____
_____
_____

B. Does the substitution affect dimensions shown on Drawings:
Yes_____ No _____ If yes, clearly indicate changes.
_____
_____
_____
_____

C. Will the undersigned pay for changes to the design, including engineering and detailing costs caused by the request substitution:

Yes _____ No _____Comment: _____
_____
_____

D. What affect does this substitution have on other trades, other Contracts, and Contract completion
date: _____
_____
_____

E. What affect does this substitution have an applicable code requirements:
_____
_____
_____

F. Differences between proposed substitution and specified item:
_____

G. Manufacturer's guarantee of the proposed and specified items are:
Same _____ Different _____ (explain): _____
_____

H. List of names and addresses of three similar projects on which product was used, date of installation, and Architect's name and address:
_____
_____
_____

I. Cost Impact: _____
_____

The undersigned attests function and quality equivalent or superior to specified items.

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE.

Submitted By:

FOR USE BY OWNER'S REPRESENTATIVE:
Accepted: ☐
Accepted as Noted: ☐
Not Accepted: ☐
Received Too Late: ☐

_____ _____
Signature Title

_____ _____
Firm

_____

_____ _____
Address

_____

_____

_____
Telephone

_____
Date

By: _____
Date: _____
Remarks: _____

_____

_____ _____

_____

_____

Signature must be by person having authority to legally bind his firm to the above term.

Concurrence by Owner's Representative: _____

END OF SECTION

SECTION 01770
PROJECT CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Related Requirements.

B. Closeout Procedures.

C. Certification that Work is Complete.

D. Final Statement of Acceptance.

E. Maintenance Materials.

F. Certification of Required Training.

G. Project Record Documents.

H. Maintenance Data Binder.

I. Warranties and Bonds.

J. Final Cleaning.

K. Finish Inspection.

1.2 RELATED REQUIREMENTS

A. General Conditions: Fiscal provisions, legal submittals, and other administrative requirements.

B. Section 01500 – Temporary Facilities and Controls: Cleaning during construction.

1.3 CLOSEOUT PROCEDURES

A. Closeout Steps:

Step 1: Contractor:

- Certifies that work is complete (1.4)
- Final statement of accounting (1.5)
- Provide maintenance materials (1.6)

- Certifies required training (1.7)
- Provides record documents (1.8)
- Provides maintenance data binder (1.9)
- Provides warranties and bonds (1.10)

Step 2: Consultant:

- Conducts punch list.

Step 3: Contractor:

- Make punch list corrections.

Step 4: Consultant:

- Punch list back check
- Issues certificate of substantial completion, and beginning of warranty period of accepted work.

Step 5: Contractor:

- Make punch list back check corrections.
- Provide final cleaning (1.11)

Step 6: Consultant:

- Final statement of acceptance, recommended date of acceptance, and beginning of warrantee period on any work not accepted at substantial completion.

B. Upon issuance of Certificate of Substantial Completion, the Contractor shall complete all punchlists within thirty (30) consecutive days from date of Substantial Completion.

B. Owner will occupy designated portion of Project for the purpose of conduct of business, under provision stated in Certificate of Substantial Completion.

1.4 CERTIFICATION THAT WORK IS COMPLETE

A. When Contractor considers Work has reached final completion, submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Owner's Representative's inspection.

1.5 FINAL STATEMENT OF ACCOUNTING

A. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

B. Owner will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.6 MAINTENANCE MATERIALS

A Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of Work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

1.7 CERTIFICATION OF REQUIRED TRAINING

A. Certification that all required training of Owner's maintenance and operating personnel has been completed.

1.8 PROJECT RECORD DOCUMENTS

A. General:

1. Store project Record Documents separate from those used for construction.

2. Keep documents current; Record information concurrently with construction progress, do not conceal any work until required information is recorded.

3. Record final information by transferring information onto one (1) clean set of construction drawings and in a copy of a Project Manual provided by the Owner.

4. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information on copies of construction drawings used during the course of construction.

5. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

6. Review the as-built drawings with the Owner’s Representative to review accuracy and completeness. Make revisions as required.

B. Submit Record Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:

1. Measured depths of elements.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed on construction, referenced to visible and accessible features of construction.
4. Field changes of dimension and detail.
5. Changes made by Modifications.
6. Details not on original Contract Drawings.

C. Submit Record Specifications: Legibly mark each item to record actual construction, including:

1. Manufacturer, trade name, and catalog number of each Substitute item.
2. Changes made by Addenda and Modifications.

C. Road and Storm Drainage: See Section 01300, 1.13 for Requirements.

1.9 MAINTENANCE DATA BINDER

A Submit one (1) set prior to final inspection, bound in 8-1/2 x 11 inch (216 x 279 mm) three-ring hard cover side binder with clearview, and durable plastic covers with title inserts. Make corrections noted by Owner's Representative and resubmit one (1) copy for final review.

1. Part 1: Directory, listing names, addresses, and telephone numbers of:
   a. Owner, Architect, and Contractor.
   b. Subcontractors and Suppliers.
2. Part 2: Tab each specification section/product as specified in the technical sections and in Division 1-General Requirements:
   a. Name, address, phone number of contractor/supplier.
   b. Written warranties (see 1.10).
   c. Maintenance instructions.
   d. Parts lists.
   e. Instructions and operation manuals.

B Submit material prior to final application for payment. For equipment put into use with Owner's permission during construction, submit within ten (10) days after first operation. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing date of acceptance as start of Warranty period.

1.10 WARRANTIES AND BONDS

A. Manufacturer, Supplier, Subcontractor Warranties & Bonds

1. Provide duplicate, notarized copies executed by subcontractors, suppliers, and manufacturers.

2. Warranty to include the periods of time specified, beginning from date of substantial completion. Warranty letter to be substantially as follows:

(Owner)
(Address) *RE: (Project)*

Gentlemen:

We as Subcontractor and Contractor, do hereby warrant for a period of ( ) year(s) from the date of substantial completion that portion of the work incorporated in the project by (subcontractor) as described below:

( )
We will remedy at our expense any defects appearing during that period due to poor or defective materials and/or workmanship and will pay for any damage resulting from occurrence of said defects of the correction of same.

This warranty shall not be interpreted as holding the Contractor responsible for normal wear or any deterioration of work due to abuse of the work by the Owner.

Sincerely,

_____
Subcontractor

_____
Contractor

1.11 FINAL CLEANING

A. Execute prior to final inspection by Owner.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances, polish transparent and glossy surfaces. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment. Clean drainage systems and structures.

C. Clean site; sweep paved areas, rake clean other surfaces.

D. Legally dispose of all debris and construction materials not retained by Owner, off site.

E. Owner shall review final cleaning for approval.

1.12 FINAL INSPECTION

A. After final cleaning the contractor shall call for final inspection.

B. The architect will provide a punch list of incomplete or unacceptable items.

C. Once the contractor has completed the punch list corrections the contractor shall request a follow up inspection. Any items still found incomplete or unacceptable will be corrected within 7 working days.

D. The punch list correction must be completed within the contract time of completion.

E. See General Provisions 1.05.11 (2) Final Inspection Date.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

CITY OF SEATAC

RIVERTON HEIGHTS PARK IMPROVEMENTS

Certificate of Landscape Architect:

The specifications contained herein have been prepared by or under the direction of the undersigned, whose seal as a Professional Landscape Architect to practice In the State of Washington, is affixed below.

01 56 39
03 30 00
03 35 33
31 00 00
31 10 00
31 22 16
32 11 23.23
32 12 16
32 13 13
32 17 00
32 17 23.28
32 18 16.13
32 31 13
32 41 00
32 50 00
32 80 00
32 91 13
32 92 19
32 93 00
32 93 01
32 96 00
33 46 16



Brice Maryman, PLA
Signed 8/28/2026

Engineer's Stamp

The Engineer's seal and signature affixed hereon indicates this Consultant's review and participation in the preparation of the Project Manual. Participation includes and is limited to the following specification sections:

33 11 00	Water Distribution Piping
33 31 13	Sewage Piping
33 40 00	Storm Drainage Utilities
33 40 10	Underground Detention System
33 40 20	Stormwater Media Cartridge Filtration System
33 46 16.19	Pipe Underdrains



Mechanical Engineers' Stamps

The Mechanical Engineer's seal and signature affixed hereon indicates this Consultant's review and participation in the preparation of the Project Manual. Participation includes and is limited to the following specification sections:

13 11 05	Common Work Results for Water Recreation Systems
13 11 17	Sleeves and Sleeve Seals for Water Recreation Systems
13 11 48	Vibration and Seismic Controls for Water Recreation Systems
13 15 10	Spray Park Systems
13 15 13	Spray Park Piping
13 15 16	Spray Park Pumps
13 15 19	Spray Park Water Treatment Equipment
13 15 23	Spray Park Water Features
22 05 00	Common Work Results for Plumbing
22 05 19	Meters and Gages for Plumbing Piping
22 05 23	General-Duty Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 33	Heat Tracing for Plumbing Piping
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 13	Facility Water Distribution Piping
22 11 19	Domestic Water Piping Specialties
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 33 29	Submersible Sewerage Pump Systems
22 33 36	Electric Commercial Water Heaters
22 45 00	Emergency Plumbing Fixtures
23 05 00	Common Work Results for HVAC
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 07 13	Duct Insulation
23 08 10	Requirements for Startup
23 31 00	HVAC Ducts and Casings
23 33 00	Air Duct Accessories
23 34 00	Fans
23 37 00	Air Outlets and Inlets



08/28/2026

Electrical Engineers' Stamps

The Electrical Engineer's seal and signature affixed hereon indicates this Consultant's review and participation in the preparation of the Project Manual. Participation includes and is limited to the following specification sections:

26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33.13	Conduit for Electrical Systems
26 05 33.16	Boxes for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73	Power System Studies
26 09 23	Lighting Control Devices
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 13	Fuses
26 28 16.16	Enclosed Switches
26 43 00	Surge Protective Devices
26 51 00	Interior Lighting
26 56 00	Exterior Lighting

27 05 00	Common Work Results for Communications
27 05 26	Grounding and Bonding for Communications Systems
27 05 53	Identification for Communications Systems
27 08 00	Commissioning of Communications Systems
27 11 16	Communications Cabinets, Racks, Frames, and Enclosures
27 11 19	Communications Termination Blocks and Patch Panels

28 05 00	Common Work Results for Electronic Safety and Security
28 05 13	Conductors and Cables for Electronic Safety and Security
28 05 26	Grounding and Bonding for Electronic Safety and Security
28 05 28.33	Conduits and Backboxes for Electronic Safety and Security
28 08 00	Commissioning of Electronic Safety and Security Systems
28 20 00	Video Surveillance - Axis



06/09/2027

SECTION 03 30 00
CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and steel connections and anchorage into cast-in-place concrete, excluding those elements identified in Section 32 13 13 – Cement Concrete Paving.

1.2 RELATED SECTIONS

A. Coordinate with related Work specified in other parts of the Project Manual.

B. Coordinate with the General Conditions and Supplemental Conditions in the Contract.

1.3 REFERENCES

A. Reference the following standards:

ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
AASHTO	American Association of State Highway and Transportation Officials
NRMCA	National Ready Mixed Concrete Association
CRSI	Concrete Reinforcing Streel Institute

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

C. Material certificates.

D. Material test reports.

E. Test Results.

F. Concrete Formwork and Installation qualifications.

G. Concrete Color Admixture

H. Reinforcing bar shop drawings and placing plans.

I. Non-shrink grout material specifications and manufacturer’s installation recommendation

J. Fabrication shop steel registration/ certification or quality control inspection records

K. Structural steel shop drawings

L. Fabrication shop steel registration/ certification or quality control inspection records

M. Certification of conformance for welding material, including supplemental notch toughness requirements

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Concrete formwork and installation contractor shall be a company specializing in the Work of this Section with a minimum 5 years documented experience in concrete installation of a similar nature.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.6 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1.

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).

1.7 DELIVERY, STORAGE AND HANDLING

A. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry conditions.

1.8 PROJECT CONDITIONS

A. Integrally Colored Concrete Environmental Requirements:

1. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.

2. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours. Protect fresh concrete from moisture and freezing.

B. Comply with professional practices described in ACI 305R and ACI 306R.

C. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturer's written recommendations.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: For concrete that will be seen by the public, provide form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: For sides of the concrete that will not be seen by the public, plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCING

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II.
2. Fly Ash: ASTM C 618, Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: ASTM C 94/C 94M and potable.

F. Concrete Color for cast-in place elements that are not seat and retaining walls (e.g. sculpture foundations) shall be ASTM C979 compliant. Mix in ratios as recommended by the manufacturer to achieve the colors described below:

1. Solomon Color shall be #600 Ceramic Integral Concrete Color per https://www.solomoncolors.com/concrete-colors/dry.html, or
2. Approved equal

G. Concrete Color for Seat and Retaining Walls shall be ASTM C979 compliant. Mix in ratios as recommended by the manufacturer to achieve the colors described below:

1. Solomon Color shall be #920 Smoke Integral Concrete Color per https://www.solomoncolors.com/concrete-colors/dry.html, or
2. Approved equal

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.8 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Normal-Weight Concrete:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum W/C Ratio: 0.44
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 GROUTING STEEL BASE PLATES

A. Non-shrink grout for base plates shall be an approved non-shrink cementitious grout containing natural aggregates delivered to the job site in factory prepackaged containers requiring only the addition of water. The minimum 28-day compressive strength shall be at least twice the specified compressive strength of the underlying concrete. Grouts shall meet ASTM C1107. Approved grouts include: Master Builders' "Master Flow 713," Sika Corporation's "Sikagrout 212," Burke Company's "Nonferrous Nonshrink Grout", W.R. Meadows CG-86 Construction Grade Grout," or approved equal. Grout shall be mixed, applied, and cured strictly in accordance with the manufacturer's recommendations.

2.11 STRUCTURAL STEEL

A. Fabricators for structural steel must have a quality assurance program in place. The quality assurance program must meet the requirements of one of the following methods: registration in the Washington Association of Building Officials (WABO) Steel Fabricator Registration Program or participation in the AISC quality certification program, designation as an AISC Certified Plant, Category BU.

B. All steel noted as galvanized and any steel in ground contact or within 6-inches of grade shall be zinc-plated (galvanized) by the hot-dipped galvanic method (or pre-approved equivalent), except where such steel is be fully encased in concrete. Any surface where the coating has been removed or damaged shall be brushed and re-coated in clean, dry field conditions with an approved zinc-based anti-corrosion coating except where such area is to be encased in concrete.

C. All steel to be shop primed. Steel encased with concrete need not be painted. All other steel shall be given one coat of shop paint, in accordance with Section M3 of the AISC "Specification" and Section 6.5 of the AISC "Code", unless noted otherwise. The surface preparation of the structural steel prior to painting shall be in accordance with the specific paint manufacturer's published recommendations. Structural joints and faying surfaces which are to be connected by means of welds or bolts shall not be painted until all welds and bolts are installed, inspected, and approved. Paint shall be held back 3" from the faying surface or joint to be welded.

D. Where noted per Contract Documents, steel below grade shall be painted with an asphaltic emulsion, which shall be "Henry 107" by Henry Company or approved equivalent.

E. Plates and angles shall be ASTM A36, Grade 36.
F. Anchor rods shall be ASTM F1554, Grade 36.
G. Hex nuts shall be ASTM A563.
H. Plates specified as stainless steel per Contract Documents shall be ASTM A304.
I. Anchor rods specified as stainless steel per Contract Documents shall be ASTM A304.
J. Hex nuts and washers specified as stainless steel per Contract Documents shall be ASTM F594.

2.12 ANCHORAGE

A. Adhesive anchors with threaded rods as specified on the drawings shall be installed using “HIT-HY 200” as manufactured by the Hilti Corporation. Install in strict accordance with ICC Report No. ESR-4868. Special inspection of installation is required. Care shall be taken in placing post-installed anchors to avoid conflicts with existing rebar: existing reinforcement shall not be cut or damaged.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Do not chamfer exterior corners and edges of permanently exposed concrete. Tool edges.

3.2 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.3 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner’s Representative.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3.5 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. Integrally Colored Concrete: Apply curing compound for integrally colored concrete according to manufacturer's instructions using manufacturer’s recommended application techniques. Apply curing compound at consistent time for each pour to maintain close color consistency.

F. Curing compound shall be same color as the colored concrete and supplied by same manufacturer of the colored admixture.

G. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 Plastic Shrinkage Cracking published by the National Ready Mixed Concrete Association.

H. Do not cover concrete with plastic sheeting.

3.7 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas where required by Owner. Remove and replace concrete that cannot be repaired and patched to Owner's approval.

3.8 WELDING

A. All welding shall be in conformance with ASIC and AWS standard and shall be performed by AWS/ WABO certified welders using E70XX Electrodes in accordance with AWS D1.1. Only prequalified welds as defined by AWS shall be used.

B. Welding of galvanized steel shall conform to AWS Specification D-19.0. Welded areas of galvanized steel shall be touched up in conformance with ASTM A-780.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Inspect reinforcement and verify placement.
2. Anchors cast in concrete.
3. Adhesive anchors post-installed in hardened concrete members.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from slabs.
8. Welding of structural steel per Contract Documents.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
9. Test results shall be reported in writing to Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Owner. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Owner.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

SECTION 03 35 33
EXPOSED AGGREGATE FINISHING

PART I - GENERAL

1.1 SUMMARY

A. A Section Includes

1. Finishing materials and methods for producing decorative exposed aggregate slab and wall finish, including the use of chemical surface retarders
2. Curing and sealing of concrete surfaces.

B. B Related Sections

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections
2. Section 03 30 00 Cast in Place Concrete

1.2 REFERENCES

A. ASTM International (www.astm.org)

B. American Concrete Institute (www.concrete.org)

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:

1. Attendance: Landscape Architect, Owner’s Representative, Contractor, Installer, and related trades.
2. Review: Project conditions, manufacturer requirements, delivery, and storage, staging and sequencing, and protection of completed work.

1.4 SUBMITTALS

A. Action Submittal

1. Shop Drawings including patterns and exposure depths
2. Product Data: Manufacturer’s descriptive data and product attributes for each product.
3. Samples: 1 liter or greater samples of aggregates

B. Informational Submittal

1. VOC Compliance [if Applicable.]
   a. Based on SCAQMD Rule 1113 for VOC compliance
      1) Concrete surface retarder, not to exceed 250 g/l or comply with the low solids exception of less than 80 g/l.
      2) Sealers, not to exceed 100 g/l.
   b. Or CDPH Standard 1.2 VOC Emissions compliant

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years' experience in work of this Section.

B. Mockups: Minimum 4 x 4 feet. Show each concrete color and finish.

1. Prepare mock-up panel(s) at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of aggregate exposure.
2. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor.
3. Mockups shall be maintained for the duration of the project

C. Review: Project conditions, manufacturer requirements, delivery, and storage, staging and sequencing, and protection of completed work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Solomon Colors, Inc.; 4050 Color Plant Rd., Springfield, IL. 62702;

1. Tel: (800) 624--0261; Website: www.solomoncolors.com
2. Contact: ArchitecturalTeam@SolomonColors.com

B. Substitutions: Refer to Division 01.

2.2 MATERIALS

A. Concrete Materials: Specified in Section 32 13 13.

1. Aggregate Topdressing shall be comprised of 3/8" Ivory Rounded Seaside Aggregate from Cascade Stoneworks. 19050 13th Place S., Suite 102, SeaTac, WA 98148, 206-737-8364, info@cascadestoneworks.com

2. Aggregate Considerations: Graded and washed aggregate and sand to achieve consistent appearance.
    a. Special size/color aggregate to be approved at mockup
    b. Ratio of sand to aggregate per manufacturer's recommendation to achieve the desired exposure depth and appearance.
    c. Single Source Cements and Aggregates for batch consistency for the entire project.

B. Colloidal Silica Concrete Surface Treatment: Single component colloidal silica-based admixture for improving surface properties; Reducing efflorescence in colored concrete, improving workability for consistent aggregate exposure, Improving the bond between aggregate and concrete paste for more durable exposed aggregate finishes.

1. Product: Day 1 Surface Technology by Solomon Colors, Inc. www.solomoncolors.com
    a. Material Type: Water-based, colloidal silica blended surfactant
    b. VOC Content: < 50 grams per liter.
    c. VOC Emissions: CDPH Standard 1.2 VOC Emissions certified

C. Fibrous Reinforcement: Cellulose micro-fiber designed to provide secondary reinforcement. Reduces plastic shrinkage cracking and remains invisible on decorative surfaces. Provides superior finishing qualities, while cleanly accepting color and decorative finishes.

1. Product: UltraFiber 500 by Solomon Colors, Inc. www.solomoncolors.com
    a. Material: Alkali-resistant natural cellulose fibers.
    b. Meet ASTM A820/A820M, ASTM D7357, and ASTM C1116, Section 4.1.4, Type IV.
    c. Stability: Exceed ICC-ES requirements of 90 percent average Zero-Span Stability Ratio (ZSSR) after exposure to saturated calcium hydroxide and 1.0N sodium hydroxide, tested to ASTM D6942.

D. Color Pigment: Iron oxide concrete pigment meeting ASTM C979/C979M; light-fast, insoluble, and alkali resistant, in powdered, liquid, or granular form.

1. Source: Iron Oxide Pigment or Brickform Powdered Integral Color by Solomon Colors, Inc. www.solomoncolors.com
2. Color: 920 Smoke

E. Surface Retarder: Water based treatment designed to retard the hydration of top layer of concrete paste, producing an exposed aggregate, or sand finish appearance. Product may be used on both horizontal and vertical surfaces

1. Source: Brickform Select-Etch by Solomon Colors, Inc. www.solomoncolors.com
2. Exposure depth: 1/8"

Item #	Color	Agg Exposure	Exposure Depth
SE75	Blue	1/8” - 3/8”	1/8” (3.2 mm)

F. Curing and Sealing: Curing and sealing products to be determined at time of mockup. Some products or methods may not be compatible with project requirements. Considerations include VOC requirements, desired sheen, color enhancement, and environmental conditions. Refer to Solomon Colors’ product data for assistance with selecting the proper curing and sealing product(s).

1. Concrete Curing Compound: Clear, film-forming curing/sealing compound, suitable for decorative concrete. Reference ACI 310R
   a. Water-based
   b. Product: Brickform Gem Cure and Seal by Solomon Colors, Inc. www.solomoncolors.com

2. Concrete Surface Sealer: VOC compliant, clear acrylic or penetrating sealer, designed to reduce porosity of exposed aggregate concrete surface
   a. Water-Based Acrylic Sealer: Film forming, satin sheen
      1) Product: Brickform Gem Cure and Seal WB by Solomon Colors, Inc. www.solomoncolors.com
   b. Water-Based Penetrating Sealer: Natural look with no sheen and no film
      1) Product: Brickform Stealth Seal WB by Solomon Colors, Inc. www.solomoncolors.com
   c. Solvent-Based Acrylic Sealer: Film Forming, high gloss, color enhancement
      1) Product: Brickform Gem Seal by Solomon Colors, Inc. www.solomoncolors.com
   d. Solvent-Based Hybrid Penetrating Sealer: Low sheen, color enhancement
      1) Product: Brickform Gem Guard by Solomon Colors, Inc. www.solomoncolors.com

PART 3 - EXECUTION

3.1 GENERAL

A. Apply Materials in accordance with manufacturer’s recommendations

B. Methods and materials shall match that of approved mockup production

3.2 CONCRETE FINISHING

A. Follow standard practices and reference Section 32 13 13.

B. Install aggregate topdressing while concrete is still wet. Top seed so that aggregates are densely and evenly located acoss the top of all surfaces.

C. Exposed Aggregate Finishing

1. Do not use tools that may force the aggregate away from the surface creating a non-uniform surface after exposure.
2. Finish slab surface to be uniform, flat, without low spots or ridges. Do not overwork the surface to be exposed.

3.3 COLLOIDAL SILICA SURFACE TREATMENT INSTALLATION

A. After screed and immediately before bull float for concrete performance application

1. Spray-apply to concrete surface with uniform coverage
2. Typical Coverage will be appx. 300-500 ft2/gallon

B. At time of troweling and/or hand finishing for finishing aid application

1. Spray Apply as needed to facilitate finishing operations and surface lubrication
2. Typical coverage will be 800-1000 ft2/gallon

C. Prevent overspray of material to adjacent equipment and construction materials.

3.4 CONCRETE SURFACE RETARDER INSTALLATION

A. Protect all adjacent concrete surfaces, pavers, stones, borders, etc. that are not to receive retarder finish prior to concrete placement and retarder application

B. Application

1. Spray the Concrete Surface Retarder with low-pressure sprayer at a rate of 250-300ft2/gallon
2. Maintain an even continuous application.
3. Once dry, Concrete Surface Retarder will yield a coating that provides intermittent rain protection. Protect the surface if heavy extended rains are predicted or during extremely hot weather to retain moisture and protect the etch retention.

C. Removal

1. Concrete Surface Retarder can be removed when the underlying concrete has sufficiently hardened, typically ranging from 5 to 12 hours after initial placement.
2. Do not exceed 24 hours before removing
3. Wash surface with running water with a push broom, high pressure washing, or a rotary buffer with bristle attachment and water.

4. Timing and removal should be determined by the project testing and jobsite samples. When using light etches, it is generally better to remove Surface Retarder the same day.
5. Dispose of wash water slurry in accordance with environmental regulations per relevant jurisdictional authority.

3.5 CONCRETE CURING AND SEALING COMPOUND INSTALLATION

A. Curing Compound

1. After water from removal has dissipated from the slab, apply curing compound uniformly.
2. Follow manufacturer's recommendations for coverage, methods, and environmental allowances.

B. Sealer

1. After recommended cure time has been achieved, apply surface sealer.
2. Follow manufacturer's recommendations for coverage, methods, and environmental allowances.

3.6 CONCRETE REPAIR AND PROTECTION

A. Repair and patch defective areas using the same materials as the original concrete. Place, finish, and cure to achieve a blended appearance with adjacent concrete.

B. Remove and replace damaged areas that do not comply with requirements in this section. Replacement areas should be made between joints or other visible termination point.

C. Protect finished concrete from staining, soils, and other foreign material until completion.

D. Follow recommended continuing maintenance procedures.

END OF SECTION

SECTION 13 11 05

COMMON WORK RESULTS FOR WATER RECREATION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Common work results for Water Recreation Systems, including:
   2. Spray park systems (1315xx series specification sections).
      a. Recirculating spray parks.

B. Design-build requirements for water recreation mechanical systems.

1.2 SUMMARY

A. All specification sections for water recreation systems are complementary and shall be understood to reference each other.

B. Contractor shall provide complete and functional water recreation systems.

1.3 REFERENCE STANDARDS

A. General: References used throughout Division 13 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.

B. AISC Steel Handbook.

C. ASHRAE Applications Manual.

D. ASME 31.9 - Building Services Piping.

E. ASTM D1557 - Method of Test for Moisture Density Relations of Soils.

F. IBC - International Building Code.

G. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.

H. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

I. NFPA 70 - National Electrical Code.

J. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

K. UPC - Uniform Plumbing Code.

L. WAC 51-11C - Washington State Energy Code, Commercial Provisions.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide product data for all components and equipment provided under this Division.
   1. Product sheets with more than one item or option shown shall have the product(s) and options to be used on the project clearly identified.
   2. Any equipment or materials installed or furnished without prior approval of the Owner's Representative shall be rejected and such materials will be required to be removed and replaced with approved materials at the expense of the Contractor.

C. Shop Drawings:
   1. Shop drawings shall be submitted for review and approval prior to beginning work.
   2. Shop drawings shall indicate routing of piping and location of all equipment to be provided, and shall reflect coordination with other disciplines and existing conditions.

D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports, inspection reports, and startup reports.

F. Project Record Documents:
   1. Record actual routing of installed piping, including elevation (or depth for buried piping).
   2. Record actual equipment and components installed, as well as locations.
   3. RFI's, change orders, and the like shall be noted on the Record Documents where these affect the layout or other aspect of project shown on the documents. References to these shall include the RFI/change order number as well as written description(s), sketch(es), etc., indicating the change or clarification.
   4. Record actual location of installed valves and control components.
      a. Include riser diagram(s) and schedule of valve tags and locations.
   5. Final record documents:
      a. Upon completion of the project the as-built information shall be neatly transferred to a clean set Plans. This set of Plans shall be submitted for final approval and acceptance.

G. Operation and Maintenance (O&M) Data:
   1. Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

2. Include manufacturer's warranty information, including any extended warranties, or certifications of warranties required for specific products, systems, or installations.
3. Include certification of inspection(s) from the Authority Having Jurisdiction for the applicable work scope(s).
4. Include certification of training.
5. Include certification of Contractor's one-year warranty of materials and workmanship, including effective date(s) of warranty period.

1.5 QUALITY ASSURANCE

A. Manufacturers: Refer to specific water recreation specification sections for requirements.

B. Contractors: Refer to specific water recreation specification sections for requirements.

C. Backflow Testing: All testing of backflow prevention equipment shall be done by a Washington State Certified Backflow Assembly Tester (BAT) certified to work in buildings.

D. Electrical Work:
1. Contractor: Electrical work required under this Division shall be performed by a Washington State Licensed Electrician.
2. Electrical work required under this Division shall require an Electrical Permit.
    a. Electrical permit shall be procured by the water recreation system contractor or their electrical subcontractor.
3. Electrical Equipment
    a. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical hookup, such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., shall be provided with an approved label from either Underwriters Laboratories (UL), the American Gas Association (AGA) or the Canadian Standards Association (CSA).
    b. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector.
    c. It shall be the responsibility of the Contractor to meet the Agency Approval requirements of this section. Any allowance for agency costs to provide appropriate label for a piece of equipment must be included in this Bid and Contract. Failure by the Contractor or supplier to obtain labels associated with agency approval prior to bid shall be sufficient cause for the Contractor to obtain all such labels and approvals at no additional cost to Owner.

E. Performance Certification: All equipment performance (water flow, heating capacity, etc.) shall be certified by a recognized national agency such as the Air Conditioning and

Refrigeration Institute (ARI), Air Movement and Control Association (AMCA) and the American Society of Mechanical Engineers (ASME).

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.

C. Protect products from weather and moisture. Provide coverings of plastic or canvas. Cover openings into pipe and duct. Isolate components from contact with the soil. Provide a means of heating for those components that may become damaged by high or low temperatures.

D. For extended outdoor storage, remove motors and other electrical equipment from enclosures not designed for outdoor use and store separately.

1.7 DEFINITIONS

A. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

B. The term "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refer to those subcontractors working under the direction of the General Contractor (GC).

1.8 MISCELLANEOUS REQUIREMENTS

A. Intent of Drawings
   1. The drawings are intended to depict the general scope of arrangement. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in ductwork and piping. Provide additional fittings, offsets and extensions in piping, ductwork and related mechanical insulation to provide full systems functionality and to assure access for equipment maintenance and as detailed elsewhere in the contract. Relocate or shift piping and ductwork where conflict exists with other mechanical systems, Structure, Architecture or Electrical. Report conflicts before proceeding with work. Provide reasonable planning and layout in advance of installation in order to avoid conflicts and delays. The Contractor will be directed to adjust systems due to conflicts that could have been reasonably foreseen at the Contractor’s own expense.
   2. Examine the Architectural, Landscape Architectural, Civil, Structural, Mechanical, Plumbing, Electrical, and other drawings before work is started, consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to provide reasonable coordination shall result in the Contractor, at his own expense, moving his work to provide the necessary space for the other Contractors.

B. Permits and Fees: Obtain and pay for all permits and construction fees. Furnish Final Certificate to Owner showing compliance with code requirements.

C. Scheduling: Comply with requirements of Division 1.

D. As-Specified Equipment: These specifications and drawings; generally list only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition the listed product is the basis of the design regarding physical size, capacity, electrical power requirements and performance. The product so identified is designated "as specified."

E. Prior Approvals:
   1. Specifications have been written around equipment and materials selected for this project based on quality, size, capacity, and performance required to meet building design criteria. All equipment and materials used in this project that have been specified around a specific product or products shall have prior approval for product substitutions.
   2. Request for Approval must be submitted in accordance with Division 1 requirements.
   3. Supplier and/or Mechanical Contractor shall be responsible to ensure that substituted material or equipment is of same size, quality, capacity, weight and electrical characteristics as that specified or shown on the drawings. Any changes and cost increases required during construction due to substituted equipment; shall be paid by the Contractor/Supplier. Prior approval to bid does not mean final approval of material or equipment. Final approval will be given after final submitted data has been presented, complete with full information regarding weights, capacities, size, electrical requirements and quality.

F. Contractor's Cost Breakdown: Submit a cost breakdown (schedule of values) of the major portions of the work. Provide this submittal along with the equipment submittals. Organize the costs generally by specification section. If one Section (Copper Pipe, for example) applies to both multiple areas of work (such as plumbing and hydronics, for example), apportion the appropriate amount to each area of work.

1.9 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures and requirements.

C. Refer to Division 1 for demonstration and training requirements.

1.10 REQUESTS FOR INFORMATION

A. A Request For Information (RFI) is a formal way to ask questions, document answers and generally expedite project progress. Information requests may be submitted on any form the Contractor finds convenient, but should include the project name, a complete description of the item requested, reference drawing numbers (with location on the drawing indicated) or specification section references of where to find the item in question, and a suggested solution.

B. The Contractor shall number each of the RFI's. This numbering system; shall be sequential, and shall generally be that established by the General Contractor, unless approved otherwise.

C. Information requests submitted with a suggested solution will be processed more rapidly than those without.

PART 2 PRODUCTS

2.1 GENERAL

A. See technical specifications for detailed product specifications.

2.2 DAMAGED OR REJECTED MATERIALS

A. Damaged or rejected materials shall be removed from the site immediately upon discovery.

2.3 FIRE INTEGRITY

A. All mechanical system penetrations of fire rated assemblies shall be protected in accordance with the building code in force in the Authority Having Jurisdiction for this project. This includes piping, supports, conduit, and any other system and appurtenance provided by Division 22. In addition, all through-penetration sealing methodologies shall be listed in the Underwriter's Laboratories (UL) Fire Resistance Directory, issue current at time of bid.

2.4 MOTORS

A. Motors shall comply with the current edition of the Washington State Energy Code. Service factor for poly-phase motors shall be 1.15. Service factor for single phase motors shall be 1.35.

B. In addition to the requirements in Paragraph "A" above, motors for variable frequency drives shall be of premium efficiency and are suitable for VFD operation ("Inverter Ready") in accordance with NEMA MG-1, Part 31.4.4.2. Additionally, motors shall be acceptable to the manufacturer of the drive for inverter use. "Inverter Duty" motors are not necessarily required.

PART 3 EXECUTION

3.1 EXECUTION

A. Provide all work in accordance with ASME B31.9, Building Services Piping, the UPC, State and local Health Codes, and the requirements of the Authority Having Jurisdiction.

B. The Contractor shall comply with all applicable codes and requirements including but not limited to:
   1. The Uniform Plumbing Code (UPC), including local amendments.
   2. Washington State Department of Health requirements.
   3. Washington State RCW 18.106.
   4. Requirements of the local Authority Having Jurisdiction (AHJ).
      a. Authority Having Jurisdiction: Tacoma/Pierce County Health Department.

3.2 LAYING OUT WORK

A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work required under the Contract.

B. Exercise proper precaution to verify figures shown on drawings before laying out work and be responsible for any error resulting from failure to exercise such precaution.

C. Coordinate the utility installation with the final site grading and elevations.

D. Locate existing utility lines that will be affected by the building location before any footing work begins.

E. Report conflicts with the Plans before proceeding with the work.

F. Failure to follow reasonable precautions with regards to the instructions in this section will require Contractor to alter the work at the Contractor's expense.

3.3 ELECTRICAL WORK

A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to the NEC (NFPA 70) and all applicable codes.

B. All electrical work performed under this Section of the Specifications shall require a permit. Contractor shall obtain & pay for all required permits & fees.

C. All electrical work performed under this Section of the Specifications shall be performed by a electrician licensed in the jurisdiction where the work is performed.

3.4 WORKMANSHIP

A. Furnish and install all equipment in a neat and finished appearance. If any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall remove the equipment, reinstall and patch and paint surrounding surfaces without any increase in cost.

3.5 EXCAVATION - GENERAL

A. Provide all necessary excavation and shoring required for the proper installation of piping systems.

B. Slope sides of excavation to comply with local codes and ordinances having jurisdiction.

C. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

D. Sewer trenches shall be excavated to the grade with the bottom rounded to the outside of sewer pipes.

E. Bell holes shall be hand excavated to ensure the pipes resting for their entire length upon the bottom of the trench.

F. In case of sewer lines in rock excavation, the excavation shall be made at least 4 inches deeper than required and backfilled with sand to outside invert grades to provide cushion.

G. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

H. Secure approval to excavate for all trenches near or under footings and for backfilling of such trenches.

I. No underground lines shall be covered until the installation has been approved by both Owner's technical representatives and the Owner's Representative and Health Department Inspector.

3.6 EXCAVATION DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collection or run off areas. Do not use trench excavations as temporary drainage ditches.

3.7 EXCESS EXCAVATION MATERIAL

A. Legally dispose of dirt and debris from excavation at an off-site location.

3.8 PIPE BEDDING

A. Provide sand or pipe zone bedding mix for pipe bedding.
   1. Native soil shall not be used as pipe bedding material.
   2. Remove all rocks or other objects from bedding material that may damage piping.

B. Pipe bedding material shall be provided all around the piping, to the following minimum amounts:
   1. Below bottom of pipe: 4 inches
   2. Above top of pipe: 4 inches
   3. From each side of pipe: 4 inches

C. Pipe bedding shall be compacted mechanically to ensure even support for all buried piping systems.

3.9 SUB-BASE

A. Sub-base shall be compacted structural fill or gravel.
   1. Native soil shall not be utilized as sub-base material.

B. Minimum thickness for sub-base material, unless stated otherwise in these documents or required by component manufacturer, shall be 6 inches.

C. Compact sub-base material by the use of mechanical tampers to at least 95% of the maximum density of the soil foundations as determined by the compaction control test in accordance with the "Method of Test for Moisture Density Relations of Soils, ASTM D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described "Compaction Control Test."

D. Provide sub-base material for the following items:
   1. Concrete footings.
   2. Concrete mounting bases.
   3. Concrete foundations.
   4. Concrete catchbasins.
   5. Concrete anchor slabs or deadmen anchors.
   6. Other concrete work or precast concrete components provided under this contract.

3.10 BACKFILL

A. All backfill shall be thoroughly mechanically compacted.

B. Excess excavation shall be backfilled with gravel, sand, or native soil and mechanically compacted to give full support to the pipe.
   1. Native soil shall not be utilized as a backfill material in areas below concrete slabs, such as spray pads, concrete paving, or similar areas.

C. No cinders shall be used for backfilling where steel, iron or copper pipe is used.

D. All soil foundation areas which will in any manner support any load bearing building components shall be compacted, by the use of mechanical tampers, to at least 95% of the maximum density of the soil foundations as determined by the compaction control test in accordance with the "Method of Test for Moisture Density Relations of Soils, ASTM D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described "Compaction Control Test." Place fill in 8 inch loose layers, each layer compacted.

3.11 PIPE INSTALLATION

A. Lay pipe in straight lines with uniform slope, leaving no pockets. Care shall be taken to keep all foreign materials out of the pipes during installation.

B. All underground piping used for Water Recreation Systems shall be buried a minimum of 24 inches from finish grade to top of pipe.
   1. A minimum cover of 6 inches backfill shall be provided over all buried piping between top of pipe and bottom of surface materials such as concrete, asphalt, large gravel, rocks, or similar surfaces.

C. All piping run above the floor shall not be located over electrical panels or switchboards. This piping shall include, but not be limited to, domestic water and aquatic systems.

D. Isolation valves shall be provided on inlets and outlets of all major pieces of equipment to facilitate serving and removal of such equipment without the necessity of draining the associated system.

E. Provide detectable metallic underground tape for all buried piping. Install between 6-12 inches above piping. Color scheme and text shall be appropriate to the associated system, and can be the manufacturer’s standard color and description.

3.12 OPENINGS IN PIPES

A. Keep closed during the work.

3.13 PIPE SLEEVES AND SEALANTS

A. Refer to Section 131117, Sleeves and Sleeve Seals for Water Recreation Systems.

3.14 INSERTS

A. Inserts in concrete for the suspension of piping and equipment; shall be provided by this Contractor unless otherwise noted on the Plans. Provide as necessary for support of systems installed.

B. Inserts in poured-in-place concrete shall be Grinnell, Kinsdorf, Elcen, or approved equal.

3.15 PIPE HANGERS AND SUPPORTS

A. Refer to Section 131129, Hangers and Supports for Water Recreation Systems.

3.16 CUTTING AND PATCHING

A. General:
   1. Provide all saw cutting, core drilling, and other work (including patching) necessary for installation of plumbing systems.
   2. Prior to cutting, saw cutting, or core drilling any concrete, Contractor shall locate any reinforcing steel (rebar) and the like located in the concrete where the cutting is to be performed. Obtain specific approval prior to cutting any concrete reinforcement. Approval must be obtained for each specific instance of cutting reinforcement.
   3. Unless directed otherwise by Structural Documents, maintain the following minimum clearances from any concrete reinforcement:
      a. Reinforcing steel: 2”

B. New Work: Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. The expense for cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be borne by this Contractor.

C. Existing Structure:
   1. All necessary cutting and patching of existing structures necessary for the installation of mechanical work shall be as part of this Contract. Unless cutting and patching locations are specifically shown on the drawings, obtain approval prior to proceeding.
   2. All surfaces must be patched upon completion of work. Final finish of all patched surfaces (walls, ceilings, floors etc.) shall be done patched to match the adjacent surface.
   3. Contractor shall locate all steel in existing structure using x-ray or similar scanning equipment prior to cutting into existing structure.

3.17 ACCESSIBILITY

A. Locate valves, controllers, flowmeters, sensors, and any other equipment or components requiring operation, observation, and/or maintenance so that they are easily accessible for their intended purpose, either accessible in mechanical spaces or through access panels specified hereinafter. The Contractor shall insure that all maintainable items are easily accessible. New work items not reasonably accessible shall be modified, relocated or otherwise changed for adequate accessibility.

3.18 MAINTENANCE AND OPERATION ACCESS

A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
   1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
   2. Access door locations; shall be approved by the Architect prior to installation.

3.19 SEISMIC SUPPORT

A. Piping: Support piping per the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.

B. Seismic bracing materials shall comply with materials requirements for piping supports. Refer to Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

3.20 FIRE INTEGRITY

A. Maintain the fire rating of all assemblies (wall, ceiling, floor, etc) penetrated by mechanical systems. Provide approved firestopping materials as previously specified, and install in accordance with the conditions of the material UL listing.

3.21 PRESSURE TESTS AND IN-SERVICE TEST

A. All work under this Contract shall be thoroughly and systematically tested, both during construction and after completion. Pipe testing shall be either as specified in the appropriate specification section, or as specified in the applicable plumbing or mechanical code. Tests shall be maintained until approved.

B. Notifications shall be sent to the following parties 48 hours in advance of all tests:
   1. Architect.
   2. Owner.
   3. Authority Having Jurisdiction over the specific work to be inspected.

a. Notifications to AHJ shall be provided in accordance with requirements of each specific AHJ, including amount of advance notice allowed.

C. No systems, whether prescribed for testing or not, shall be covered or concealed in walls, in interstitial spaces, or similar without first notifying all of the above-listed parties for inspection. Failure to provide such notification of concealed systems shall be cause to require this Contractor to uncover and re-cover such systems at no additional cost.

D. A log of all tests shall be kept. The log shall note date, time of day test started, system or portion of system tested, length of test and test results.

E. The Contractor shall test the completed installation as in regular service. The systems provided under this Contract shall be operated in normal service for a period of at least a week prior to requesting substantial completion inspection, and any resulting defects repaired.

F. The Contractor; shall guarantee the entire system and all parts thereof for a period of one year from the date of final acceptance, and shall repair or replace any part which may show signs of failure in that time if such failure is due to imperfections in material or to improper workmanship.

3.22 STARTUP, BALANCING AND COMMISSIONING

A. Equipment Startup
1. Equipment startup shall be performed by factory-trained and certified technicians.
2. Provide a statement of the startup technician's qualifications if requested by the Architect or elsewhere specified.

B. Testing and Balancing
1. Provide system adjustment to demonstrate compliance with design documents.

C. Commissioning
1. Refer to Division 1 for general commissioning requirements.
2. Refer to individual technical sections for specific commissioning requirements.
3. The commissioning agent shall be hired directly by the Owner.
4. Provide system functional testing and documentation to demonstrate compliance with design documents.
5. Provide documentation to meet basic commissioning requirements of Washington State Energy Code section C408.

3.23 CLEANING UP

A. Comply with requirements of General Specifications (Division 1, General Conditions, Etc.).

B. Pipes shall be maintained as clean as possible during construction, and shall be blown clean before the building field painting operations are started. Piping shall shall be thoroughly cleaned before systems are operational. Strainers shall be cleaned prior to turning the system(s) over to the owner.

C. All equipment and material installed by this Contractor shall be properly protected from damage during the course of construction.

D. Fixtures and equipment shall be thoroughly cleaned before final inspection.

3.24 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the site, equipment, systems, and property from damage of any kind, and in particular, prevent water and dust seepage into new equipment.

B. Any damage to the site, equipment, systems, or property, caused by the Contractor shall result in the Contractor repairing or replacing the damaged item(s) at no additional cost to the Owner. This provision shall include any preventable damage caused by lack of due diligence in planning and investigation, and shall not be applied to field conditions which could not reasonably be ascertained prior to the activity causing damage.

3.25 CAULKING

A. Caulk all openings and flash around all piping passing through floors.

B. All caulking shall be waterproof, low-VOC, and zero mold growth type.

3.26 FINAL INSPECTION

A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall provide notification. It shall be understood that the work shall be essentially complete, and the open items list provided at that time. The warranty period will not start until the punchlist and back-check are complete. Additional inspections required because of lack of diligence by the Contractor will be conducted on a schedule convenient to the inspectors.

3.27 INSTRUCTION PERIODS

A. Provide 8 hours of instruction for Owner's staff.

B. Scope: Following installation of pool mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner’s staff.

C. General Description Of Instruction Period: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate

references to drawings; followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, and equipment cleaning procedures, temperature control settings and available adjustments.

D. Scheduling Of Instruction Period: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given at least two-weeks prior to the instruction period, and agreement finalized as to the date at which the instruction period is to be performed. Notify two-weeks prior to date when ready to conduct instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

3.28 ON SITE OBSERVATIONS AND SAFETY MEASURES

A. The Contractor is solely responsible to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The duty of any other individual or organization to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. The contractor shall be responsible for providing all safety measures and shall consult with the State and/or Federal Safety Agency or Inspector for interpretation whenever in doubt as to compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damages or injury to any persons or property wherever located resulting from any action or operation under this Contract or in connection with the work.

3.29 CONTINUITY OF BUILDING AND UTILITY AND SHUTDOWNS

A. General: Continuity of utilities services at the project site shall be maintained at all times. Utility systems shutdowns required for extensions, alterations or connections of new services shall be accomplished in accordance with the following requirements.

B. Shutdowns:
   1. While the site or part of the site is in operation or in use by the Owner, utilities shutdowns shall be scheduled for off-hours or low-use times as designated by the Owner, such as weekdays, evenings, or at night, if the shutdown affects the use of the surrounding buildings, project site, or surrounding areas.
      a. Where an individual shutdown is specifically coordinated with and approved by the Owner, shutdowns during high-use times shall be acceptable.
   2. Shutdowns longer than 4 hours shall be coordinated with and approved by the Owner at least 48 hours in advance.
   3. Shutdowns less than 4 hours shall be coordinated with and approved by the Owner at least 12 hours in advance.

C. Costs: The Contractor shall include in their bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes or failure to complete utilities connections within authorized shutdown periods.

D. Liability: Failure to coordinate with the serving utility or to sufficiently pursue the work in time to return utilities to service shall not constitute a basis for avoiding any contractual penalties.

END OF SECTION

SECTION 13 11 17

SLEEVES AND SLEEVE SEALS FOR WATER RECREATION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.2 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data.

C. Maintenance Data: Include adjustment instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.6 WARRANTY

A. Refer to Division 1 for additional warranty requirements.

B. Provide minimum 1 year warranty for all installed products.

C. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Pipe Passing Through Below Grade Exterior Walls:
   1. Schedule 80 PVC pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

C. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.2 PIPE-SLEEVE SEALS

A. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material from inside and outside before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations: Do not penetrate building structural members unless indicated.
   1. Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   2. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

F. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 13 11 48

VIBRATION AND SEISMIC CONTROLS FOR WATER RECREATION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

B. Seismic restraint systems.

1.2 RELATED REQUIREMENTS

A. Section 014533 - Code-Required Special Inspections and Procedures.

B. Section 033000 - Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.4 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2014.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.

G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.

H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).

J. MFMA-4 - Metal Framing Standards Publication; 2004.

K. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.6 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Seismic Controls:
   1. Include dimensioned plan views and sections indicating proposed plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
   2. Identify mounting conditions required for equipment seismic qualification.

3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
4. Indicate proposed arrangement of distributed system trapeze support groupings.
5. Indicate proposed locations for distributed system flexible fittings and/or connections.
6. Indicate locations of seismic separations where applicable.
7. Include point load drawings indicating design loads transmitted to structure at each attachment location.

E. Seismic Design Data:
1. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

F. Certification for seismically qualified equipment; identify basis for certification.

G. Field quality control test reports.

1.7 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
1. Designer may be employed by the manufacturer of the seismic restraint products.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SEISMIC CONTROL REQUIREMENTS

A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.

B. Seismic Design Criteria: ICC (IBC)/ASCE 7.

C. Component Importance Factor (Ip): Plumbing components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.

D. Seismic Qualification of Equipment:

1. Provide special certification for plumbing equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:
   1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
   2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
      a. 1.
      b. FEMA 412.
      c. FEMA 413.
      d. FEMA 414.
      e. FEMA E-74.
      f. SMACNA (SRM).
   3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
   4. Seismic Restraint Systems:
      a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
      b. Use only cable restraints to restrain vibration-isolated plumbing components, including distributed systems.
      c. Use only one restraint system type for a given plumbing component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
      d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain plumbing component in all lateral directions; consider bracket geometry in anchor load calculations.
      e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported plumbing component weight.

f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported plumbing component weight.
g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

F. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
a. Increase size of pad as required to comply with anchor requirements.
b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:
1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

H. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:

a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
c. Design displacements at seismic separations.
d. Anticipated drifts between floors.

2.2 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:
1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 014533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:
   1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Seismic Controls:
   1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
   2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
   3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
   4. Equipment with Sheet Metal Housings:
      a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
      b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
      c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
   5. Concrete Housekeeping Pads:
      a. Size in accordance with seismic design to meet anchor requirements.
      b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
   6. Seismic Restraint Systems:
      a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.

b. Install restraints within permissible angles in accordance with seismic design.
c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Seismic Controls:
1. Verify snubbing element air gaps.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 13 15 10

SPRAY PARK SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Spray park systems general requirements.

B. Electrical systems for spray parks.

C. Factory-manufactured skid systems.

D. Water feature control panels.

E. Water storage tanks (below grade).

F. Water feature manifolds.

G. Debris trap assemblies.

H. Water feature activators.

I. Flow meters.

J. Gauges.

K. Hair & lint strainers.

L. Inline strainers.

M. Filters.

N. Filtration media.

O. Variable frequency drives.

P. Valves.

1.2 REFERENCE STANDARDS

A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.

B. AASHTO Load and Resistance Factor Design Specifications

C. ANSI/ASME A112.14.1 - Backwater Valves

D. ANSI B16.5 - Pipe Flanges and Flanged Fittings

E. ASSE 1001 - Performance Requirements for Atmospheric Type Vacuum Breakers

F. ASSE 1015 - Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

G. ASTM D1784 - Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

H. ECEI BS EN 61000 - Electromagnetic Compatibility, Generic Emission Standard, Residential, Commercial, and Light Industry

I. IAPMO Uniform Plumbing Code (UPC)

J. ISO 9001 - Quality Management Systems

K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum)

L. NSF Standard 50 - Equipment for Pools, Spas, Hot Tubs, and Other Recreational Water Facilities

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Partial and incomplete submissions shall be rejected without reviews.

C. Qualifications
   1. Manufacturer qualifications.
   2. Installing contractor qualifications.
   3. Installing contractor's foreman qualifications.

D. Product Data:
   1. Include data on all products used for spray park systems, including but not limited to equipment, pipe materials, pipe fittings, valves and accessories.
   2. Include component sizes, rough-in requirements, service sizes, and finishes.
   3. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
   4. Pump information shall include type, capacity, power requirements, pump curves, and dimensional information. Pumps used in a lifting application shall include NPSH data & curves.

E. Operation Data: Include installation instructions, lubrication instructions, and assembly views.

F. Maintenance Data: Include maintenance and inspection data, replacement part numbers and availability, and service depot location and telephone number.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents:
   1. As-Built Drawings: Provide a complete set of as-built drawings with actual locations of components & piping, including depth/elevations.
   2. Provide documentation indicating final programmed spray park feature sequences.
   3. Provide documentation indicating actual final programmed sequences for all controlled items, including solenoid valves and debris trap assemblies.

1.4 QUALITY ASSURANCE

A. Suppliers
   1. Equipment & accessories shall be designed, fabricated, and tested by a manufacturer with a minimum of 10 years' documented experience and at least 10 projects of similar size and scope.
   2. Manufacturer shall certify that it applies an environmental management system which meets the requirements of ISO 140001:2004 in its design, manufacturing, sales, marketing, and servicing of recreational aquatic products and accessories.
   3. Manufacturer shall certify that it applies a quality management system which meets the requirements of ISO 9001:2008 in its design, manufacturing, sales, marketing and servicing of recreational aquatic products and accessories.

B. Installing Contractor
   1. The installing contractor shall have a minimum of 5 continuous years' documented experience installing swimming pool or spray park mechanical systems, and shall have completed at least 2 projects of similar size and scope within the last 5 years.
   2. The installing contractor shall have completed the spraypark mechanical system installation for a minimum of 2 spray park projects of similar size and scope.
   3. Where installers field-construct spray park filtration & control components (instead of them being provided as factory-built packaged systems), installing contractor shall have completed spray park mechanical system installation for a minimum of 2 spray park projects.

C. Installing Contractor's Foreman
   1. The installing contractor's project foreman shall have a minimum of 5 continuous years' documented experience installing swimming pool or spray park mechanical systems, and shall have completed at least 2 projects of similar size and scope within the last 5 years.

2. The selected project foreman shall be the contractor's primary point of contact throughout the duration of the project, and shall be on site throughout the installation process.
3. The installing contractor's foreman shall have completed the spraypark mechanical system installation for a minimum of 1 spray park project of similar size and scope.
4. Where installers field-construct spray park filtration & control components (instead of them being provided as factory-built packaged systems), installing contractor's project foreman shall have completed spray park mechanical system installation for a minimum of 2 spray park projects.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Use all means necessary to protect the materials of this section before, during and after installation. The installer shall carefully inspect all material before beginning work and report any damage to the Owner’s representatives before using said material. Any contractor-provided materials found to be unacceptable will be replaced at no cost to the Owner.

C. All protective wrappings are to be left intact through installation and then removed upon completion.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for demonstration and training requirements.

1.7 BASIS OF DESIGN

A. Piping & equipment layout shown on design drawings are based on water features manufactered by Waterplay, of Kelowna, British Columbia, Canada, Vortex Aquatic Structures International, of Pointe-Claire, Quebec, Canada, or Water Odyssey, of San Marcos, Texas, United States, including feature connection requirements, water flow rates, etc.
1. Use of other brands of water features shall require the contractor to alter the piping configuration, pipe sizing, etc. to suit that manufacturer's water feature(s).
2. Water feature supply manifold shall have (minimum) the same number of valves indicated on the design drawings.
3. Zoning shown on the design drawings shall be used regardless of water feature manufacturer.
4. Contractor shall provide shop drawings during the construction submittal process indicating proposed design for pipe sizing and layout changes to Owner's

Representative for approval. Approval by Owner's Representative shall be required prior to ordering or installation of any product or piping.

5. Contractor or manufacturer shall provide shop drawings during the construction submittal process indicating proposed location(s) of water features, including spray areas, verifying that spray areas are within the spray zones designated in the design drawings. Feature locations shall be approximately as shown on the design drawings, but may be relocated slightly to adjust for variance in spray areas between manufacturers. All relocations and changes are subject to review & approval of the Owner's Representative.
6. Configuration and function of mechanical and control systems shall be as shown on the contract documents regardless of manufacturer. Minor variations of configuration may be acceptable provided that the functionality and design intent is preserved, however all changes are subject to review & approval of the Owner's Representative.
7. In addition to the basis-of-design manufacturer indicated above, water features and systems manufactured by the following shall generally be acceptable, provided that all conditions noted above (3.03-A.1 through 3.03-A.6) are met:
    a. Waterplay, of Kelowna, British Columbia, Canada.
    b. Vortex International, of Pointe-Claire, Quebec, Canada.
    c. Water Odyssey, of San Marcos, Texas, United States.

PART 2 PRODUCTS

2.1 GENERAL

A. All spray park specialty components shall be NSF certified, where NSF-certified options exist for specific components.

B. Provide all necessary components for a complete system. Some of these components may be shown only on the Plans, but shall be provided under this Specification.

C. Provide flange connections or unions for all equipment connections.

D. Provide flange connections or unions on each side of valves that are not true-union type.

2.2 ELECTRICAL SYSTEMS

A. Provide all electrical devices such as disconnects, transformers, wiring, etc. for connection, control & power of all electrical components.

B. All wiring connections shall be watertight.

C. All wiring shall be provided in nonmetallic watertight conduit systems.

D. All electrical enclosures and devices provided for installation in spray park mechanical rooms and chemical storage rooms (including for control panels, disconnects, VFD's,

VFD bypass panels, transformers, and controllers, etc.) shall be minimum NEMA 4X rated for installation in wet and corrosive areas.

1. Enclosures shall be constructed of fiberglass, plastic, or 316 stainless steel. 304 Stainless steel enclosures shall not be acceptable.

E. Where components are contractor- or supplier-installed in electrical enclosures, each assembled enclosure and components shall be UL listed. The UL listing may be obtained by having the components and enclosure assembled in a shop capable of providing the UL listing or by having the assembly inspected and certified by a UL inspector.

2.3 FACTORY-MANUFACTURED SKID SYSTEMS

A. Factory-assembled, skid-mounted packages shall include:
   1. Piping.
   2. Variable frequency drives.
   3. Valves.
   4. Water feature valve manifold system.
   5. Spray Feature Control Panel.
   6. Sand filter(s).
   7. Chemistry control system.

B. Provide stainless steel & extruded fiberglass reinforced plastic mounting skid for main water treatment system.

C. Provide stainless steel mounting frame (combination wall & floor mount) for water feature manifold.

D. Provide stainless steel mounting frame for control panels, VFD's, chemistry controller, chemistry controller sample cell assembly, and electrical distribution panel.

E. All skids containing electrical components shall be UL listed as a complete skid assembly. UL listing of individual electrical components shall not constitute compliance with this requirement.

F. In lieu of equipment being provided as factory-assembled & skid mounted, qualified installers may field-construct the spray park water treatment & control systems.
   1. If equipment is field-constructioned, the associated skid/rack systems (floor or wall) may be omitted from project scope.

2.4 WATER FEATURE MANIFOLDS

A. Feature manifold shall be constructed of 304 stainless steel or 316 stainless steel.

B. Manifold shall be sized as shown on drawings.

C. Manifold shall include a compressed air fitting with valve to allow maintenance blowdown of water features & lines.

D. Manifold shall be provided with a water pressure gauge.

E. Feature connections
   1. Feature connections shall be sized as shown on drawings. All components of each connection (piping, valve(s), union(s), etc.) shall be full line size indicated.
   2. Ball valves for feature lines shall be true-union type.

F. Manifold assembly shall include motor-actuated butterfly valve to serve as manifold master valve. Actuator shall be powered & controlled through the spray feature control panel.
   1. Valve shall fail closed on loss of power or signal.

G. Provide stainless steel mounting frame (wall mount) for water feature manifold and UV system.

2.5 WATER FEATURE CONTROL PANELS

A. Panel shall be enclosed in a NEMA 4X housing with corrosion resistant coating. Panel shall have a 24-volt control output for each water feature control valve & drain valve in the system. Provide all necessary relays & contactors for required control functionality. The panel shall be microprocessor-based, capable of activating each valve on a time schedule or activation signal. Schedules and activation patterns shall be user-programmable for each valve. Panel shall be capable of running user-definable sequences and random sequences.

B. Panel shall be UL-listed and labeled for intended service.

C. Panel shall include an emergency stop switch.

D. Panel shall include input contacts for remote activation of specific devices. Remote activation inputs shall be user-assignable to any specific control valve or combination of valves in the system, and shall be able to trigger user-definable operational sequences.

E. Panel shall be provided with relays for control and interlocking of all required system components.

2.6 SPRAY FEATURE ACTIVATORS

A. Bollard- or Feature-Mount Type
   1. The activation bollard(s) shall be constructed of schedule 10 stainless steel structural tubing with an outside diameter of 5.563 inches (140mm) and a wall thickness of 0.134 inches (3.4mm). It shall have an overall height of 40 inches (1016mm) above final grade. It shall consist of 1 aluminum ‘stop light’ shaped

enclosure with three spaces for activation sensors mounted onto the face of the column. The standard configuration includes one bulldog activation device in the amber 'light' space, with painted aluminum red and green discs in the other two 'light' spaces. There shall be a .5 inch (13mm) condensation drain coupler and 1 inch (25mm) conduit coupler located at the base of the column 3 inches (76mm) above the base plate on opposite sides. The activation sensors send a direct signal to the controller to start a pre-programmed sequence of water play activities within the aquatic play pad. Activation bollards shall be provided with tamper proof, stainless steel security hardware for maintenance access and mounting. Activation device shall be fully encapsulated within a powder coated aluminum casing with a 316 stainless steel button, and be UV, moisture, graffiti, and impact resistant.

2. The activation bollards shall be constructed of schedule 10 stainless steel structural tubing with an outside diameter of 5.563 inches (140mm) and a wall thickness of 0.134 inches (3.4mm). It shall have an overall height of 39 inches (990mm) above final grade. It shall consist of one momentary pushbutton type activation sensor mounted onto the side of the column. There shall be a .5 inch (13mm) condensation drain coupler and 1 inch (25mm) conduit coupler located at the base of the column 3 inches (76mm) above the base plate on opposite sides. The activation sensors send a direct signal to the controller to start a pre-programmed sequence of water play activities within the aquatic play pad.

2.7 WATER STORAGE TANKS

A. The water storage tank shall be designed to provide for storage & makeup of water from the spray pad. Tank shall be constructed of heavy-duty single-wall fiberglass and approved by tank manufacturer for burial at depths suitable for installation location.

B. Pipe Connections:
   1. General:
      a. External pipe connections shall be straight PVC or straight FRP.
      b. Internal pipe connections shall be straight PVC or straight FRP.
      c. Refer to drawings for sizes.
      d. Refer to Couplings section below for couplings required at each connection classification.
   2. Provide the following pipe connections for each tank:
      a. Feature loop suction.
         1) Classification: Vacuum/negative pressure.
      b. Main drain return.
         1) Classification: Low pressure.
      c. Cold water makeup.
         1) Classification: High pressure.
      d. Overflow drain.

1) Classification: Low pressure.

e. Bypass return.
   1) Classification: Low pressure.
f. Tank drain.
   1) Classification: Low pressure.
g. Tank vent.
   1) Classification: Low pressure.

C. Electrical Connections:
   1. General:
      a. Tank shall be provided with external stubs for all required electrical connections.
      b. External & internal conduit connections shall be straight PVC or straight FRP.
         1) Waterproof bulkhead fittings for conduit penetrations shall be acceptable.
      c. Refer to drawings for sizes.
      d. Refer to Couplings section below for couplings required at each connection classification.
      e. Conduit connections for multiple low-voltage connections may be combined where appropriate and approved by NEC.
      f. Electrical connections shall be located on tank body or manway extension.
      g. All electrical connections shall be completely waterproof, suitable for complete water submersion.
   2. Provide the following electrical connections for each tank:
      a. Conduit connections for level sensors.
         1) Type: Electrical
      b. Conduit connections for level switches.
         1) Type: Electrical

D. Manway
   1. Provide tank with a mininum 36" diameter manway.
   2. Provide manway extensions required to locate tank at depth shown on drawings.
   3. Manway extensions shall be factory-provided, shipped loose for field installation.
   4. Manway extensions shall be constructed of heavy-duty single-wall fiberglass and approved by tank manufacturer for burial at depths suitable for installation location.
   5. Manway extensions shall include external connection stubs for electrical connections to tank.

E. Access Hatch Assembly
   1. Hatch shall be single-leaf or double-leaf type.
   2. Hatch shall be constructed of aluminum material.
   3. Hatch shall be a minimum of 36x36".

4. Provide hatch assembly with:
    a. Locking latch
    b. Spring assist
    c. Alumninum or steel locking hold-open arm
5. Latch shall be operable from inside tank.
6. Access hatch assembly shall be suitable for installation in traffic rated areas. Traffic rating shall meet AASHTO HS20 standards.
7. Hatch shall be factory-provided, shipped loose for field installation.
8. Provide hatch with factory-applied anti-slip coating, Thermion SafTrax TH604 or similar.

F. Internal Components:
1. Piping: Internal piping & fittings shall be Schedule 80 PVC.
2. Couplings: Refer to the Connections section above, and Couplings section below. Couplings for internal connections shall be of same type as external couplings for each connection classification.
3. Makeup Water Valve: float-valve level control device connected to makeup water line. Valve body shall be constructed of brass or stainless steel, provided with float arm and float ball.
4. Pump Suction Fittings: Provide foot valves for all pump suction connections.
5. Drain Fittings: Provide downturned pipe elbows inside tank for all drain or return connections.
6. Overflow Fittings: Provide upturned pipe elbow or vertical pipe section for water storage tank overflow drain.
    a. Backwater valve shall be provided on overflow outlet piping inside tank.
7. Bottom Drain: bottom drain from tank shall be completely flush with bottom of tank to allow complete tank drainage.
8. Return Distribution Piping: Provide return distribution piping from main drain return inlet, designed to distribute incoming water evenly throughout the water storage tank. Support distribution piping from tank wall. Supports shall be permanently fixed to tank walls.
9. Access Ladder:
    a. Ladder shall be molded fiberglass safety ladder, designed for vertical installation. Ladder rungs shall have non-slip surface.
    b. Ladder shall be factory supplied for field installation.
    c. Ladder shall be fixed to manway & bottom of tank.

G. Tank Anchorage Systems
1. Anchors for water storage tank shall be provided by contractor.
2. Provide complete anchorage system for each tank, including all anchor(s), straps, & hardware.
3. Anchorage systems shall be as approved by tank manufacturer.

4. Tank anchors for areas with high water tables shall include sufficient ballast to prevent tank floatation when tank is empty.
5. Anchors:
    a. Slab anchor type: 12" thick, dimensions of tank plus 12" per side, constructed of 3000-PSI rated concrete (minimum), with rebar reinforcement.

H. Pipe Couplings
1. Couplings for pipe connections to water storage tank shall be provided by contractor.
2. Couplings for internal pipe connections shall match those provided for the corresponding external connections.
3. Refer to connection schedule above for connection classification for each connection.
4. Low pressure connections: Straub StraubFlex 1L or Fernco 1056 series flexible couplings, with stainless steel hardware.
5. High pressure connections: Straub StraubGrip-L flexible couplings, with stainless steel hardware.
6. Vacuum/negative pressure connections: Straub StraubFlex-1L flexible coupling, with stainless steel hardware. For vacuum service, the strip insert option is required.
7. Electrical connections: NEC approved flexible connector.
    a. All electrical connections shall be completely waterproof, suitable for complete water submersion.

2.8 DEBRIS TRAP SYSTEM:

A. Provide complete packaged debris trap system including debris trap body, access hatch, diverter valve, piping connections, removable strainer basket, & concrete anchor/ballast.

B. Diverter valve:
1. Diverter valve shall be motor actuated butterfly valve type.
2. Valve actuator shall be equipped with spring-return function and shall fail to the open position (divert water to storm drain outlet) upon loss of power or control signal.

C. All wiring & electrical components & installation shall be fully sealed & gasketed, suitable for complete water submersion.

D. Provide with winterization plugs for pipe outlet to water storage tank. Plug shall be expanding rubber type.

E. Strainer Basket
1. Basket shall be fabricated from stainless steel, with stainless steel mesh strainer elements & large containment area for debris.

2. Basket shall be fully removable from debris trap assembly.

F. Access Hatch Assembly
   1. Hatch shall be single-leaf or double-leaf type.
   2. Hatch shall be constructed of aluminum material.
   3. Hatch shall be a minimum of 36x36".
   4. Provide hatch assembly with:
      a. Locking latch
      b. Spring assist
      c. Alumninum or steel locking hold-open arm
   5. Latch shall be operable from inside tank.
   6. Access hatch assembly shall be suitable for installation in traffic rated areas. Traffic rating shall meet AASHTO HS20 standards.
   7. Hatch shall be factory-provided, shipped loose for field installation.
   8. Provide hatch with factory-applied anti-slip coating, Thermion SafTrax TH604 or similar.

G. Debris Trap Anchorage Systems
   1. Anchors for debris traps shall be provided by contractor.
   2. Provide complete anchorage system for each debris trap, including all anchors & hardware.
   3. Anchorage systems shall be as approved by debris trap manufacturer.
   4. Anchors for areas with high water tables shall include sufficient ballast to prevent tank floatation when tank is empty.
   5. Slab anchors: 12" thick, dimensions of debris trap plus 6" per side, constructed of 3000-PSI rated concrete (minimum), with rebar reinforcement.

2.9 FLOW METERS:

A. Inline Type:
   1. PVC valve body, with clear lid with pre-printed flow scale and integrated check valve.
   2. Average accuracy shall be 97.8% minimum.
   3. Unit shall not require any calibration to read accurately, shall maintain accuracy even with entrained air in water stream, and shall require 0" upstream and downstream straight pipe for installation and accurate function.
   4. Flow meter shall be NSF-50 listed.
   5. Flowmeter shall be H2Flow Flowviz or approved equal.

B. Inline Type with Electronic Output:
   1. PVC valve body, with clear lid with pre-printed flow scale and integrated check valve.
   2. Average accuracy shall be 97.8% minimum.

3. Unit shall not require any calibration to read accurately, shall maintain accuracy even with entrained air in water stream, and shall require 0" upstream and downstream straight pipe for installation and accurate function.
4. Unit shall be provided with electronic sensor unit, interconnecting cable, and digital display & processing unit.
5. Digital display & processing unit:
    a. ABS enclosure with NEMA 4X/IP66 rating.
    b. LCD display for remote indication of flow rate.
    c. Auxiliary relay output(s).
    d. Analog 4-20mA output.
    e. 100-240 volt power supply for plug in or hardwire installation to power digital display & signal outputs.
6. Flow meter shall be NSF-50 listed.
7. Flowmeter shall be H2Flow Flowviz Digital or approved equal.

2.10 GAUGES

A. Pressure Gauges
    1. Manufacturers: Trerice, Ashcroft.
    2. Gauges shall be dial type, 2" or 2-1/2" dial size, 304 stainless steel case construction, 316 stainless steel tube & socket construction, 316 stainless steel internal components, glycerine filled, crimped 304 stainless steel ring, acrylic window, white aluminum dial face with black graduations and markings, ASME B40.100 compliant. Gauges shall have +/- 1.6% full scale accuracy. Gauges shall be rated for 150°F maximum service temperature.
    3. Gauge ranges:
        a. Range for each individual gauge shall be selected so that operational pressures are close to middle of gauge range.
        b. Ranges: 0 - 15 PSI, 0 - 30 PSI, 0 - 60 PSI, 0 - 100 PSI, 0 - 160 PSI, or 0 - 200 PSI.
    4. Accessories:
        a. General: Accessories indicated shall be provided for each gauge installed under this contract.
        b. 316 Stainless steel impulse dampener.
        c. 303 Stainless steel pressure snubber.
        d. Schedule 40 seamless 316 stainless steel coil syphon.
        e. 316 Stainless steel needle valve with 316 stainless steel body, seat, and stem, and teflon packing.

B. Compound Pressure/Vacuum Gauges
    1. Manufacturers: Trerice, Ashcroft.
    2. Gauges shall be dial type, 2" or 2-1/2" dial size, 304 stainless steel case construction, 316 stainless steel tube & socket construction, 316 stainless steel

internal components, glycerine filled, crimped 304 stainless steel ring, acrylic window, white aluminum dial face with black graduations and markings, ASME B40.100 compliant. Gauges shall have +/- 1.6% full scale accuracy. Gauges shall be rated for 150°F maximum service temperature.

3. Gauge ranges:
    a. Range for each individual gauge shall be selected so that operational pressures are close to middle of gauge range.
    b. Ranges: 30" Hg - 15 PSI, 30" Hg - 30 PSI, 30" Hg - 60 PSI, 30" Hg - 100 PSI, 30" Hg - 150 PSI, or 30" Hg - 300 PSI.
4. Accessories:
    a. General: Accessories indicated shall be provided for each gauge installed under this contract.
    b. 316 Stainless steel impulse dampener.
    c. 303 Stainless steel pressure snubber.
    d. Schedule 40 seamless 316 stainless steel coil syphon.
    e. 316 Stainless steel needle valve with 316 stainless steel body, seat, and stem, and teflon packing.

C. Vacuum Gauges
1. Manufacturers: Trerice, Ashcroft.
2. Gauges shall be dial type, 2" or 2-1/2" dial size, 304 stainless steel case construction, 316 stainless steel tube & socket construction, 316 stainless steel internal components, glycerine filled, crimped 304 stainless steel ring, acrylic window, white aluminum dial face with black graduations and markings, ASME B40.100 compliant. Gauges shall have +/- 1.6% full scale accuracy. Gauges shall be rated for 150°F maximum service temperature.
3. Gauge ranges:
    a. Range for each individual gauge shall be selected so that operational pressures are close to middle of gauge range.
    b. Ranges: 30" - 0" Hg.
4. Accessories:
    a. General: Accessories indicated shall be provided for each gauge installed under this contract.
    b. 316 Stainless steel impulse dampener.
    c. 303 Stainless steel pressure snubber.
    d. Schedule 40 seamless 316 stainless steel coil syphon.
    e. 316 Stainless steel needle valve with 316 stainless steel body, seat, and stem, and teflon packing.

2.11 FOOT VALVES:

A. 8” And Smaller: PVC butterfly check valve.

2.12 CHECK VALVES:

A. 8” And Smaller: PVC butterfly check valve. Provide true-union construction, or unions or flanges on each side of check valve for maintenance.

B. 8" And Smaller, Backwater valves: ASTM D1784 cell classification 21454 PVC construction, EPDM valve seats, external arrow flow indicator, 43 PSI pressure rating at 73°F, socket ends for piping connections, threaded plug top to service access, snap-in flapper valve. Valves shall conform to ASME/ANSI A112.14.1 for Backwater Valves.

2.13 HAIR & LINT STRAINERS

A. Separate from pump:
   1. General: ANSI/NSF Standard 50 compliant. Provide strainer pressure rating greater than maximum system working pressure.
   2. Body: FRP construction, PVC flanges, clear plastic lid, NSF rated.
   3. Strainer Basket: FRP end caps, 16-guage stainless steel strainer element in vertically-pleated non-welded configuration. Minimum 4:1 open area ratio between strainer basket open area to influent flange connection size. Self aligning/self-draining design. Molded flow arrow indicator on top of basket.

2.14 INLINE STRAINERS

A. Wye-Pattern Inline Strainers (PVC):
   1. Clear PVC body, with flanged or socket ends, threaded removable end cap with drain plug, #20 mesh PVC screen elements, rated for 90 PSI at 73°F.

B. Wye-Pattern Inline Strainers (Stainless Steel):
   1. 304 or 316 Stainless steel body, with flanged or grooved ends, lead free construction, ASTM A-276 304 stainless steel strainer mesh, removable cover/mesh retainer with 2-bolt grooved-style connection, EPDM gaskets, ASTM B-633 steel hardware, NSF 61 and FDA compliant.

C. Strainer elements (all types): Provide (1) spare strainer basket for each strainer.

2.15 FILTERS:

A. Vertical Sand Filters:
   1. Filter System: The filter tank system shall consist of a vertical filter tank consisting of internal overhead distribution system, internal lower collection system, 60 PSIG internal automatic air relief, integrally molded drain/dump port, saddle support. All of which shall be fabricated in a fully assembled state by the original equipment manufacturer, then disassembled for shipping to prevent damage to internal parts or face piping. Filter shall be NSF rated. Filter tank dimensions, flow rate, and other performance data shall be as indicated on the Drawings.
   2. Filter Tanks: The filter tank shall be a one-piece fiberglass reinforced tank with a UV resistant finish. The tank shall consist of a heavy duty closure pressure gauge,

air relief valve, swing away diffuser, threaded internal parts, internal air bleed, threaded bulkhead connectors, and combination sand and water drain.

3. Internal Distribution/Collection System: Internal filter tank equipment shall include an upper distribution system and lower collection system, hydraulically balanced to prevent turbulence and/or displacement of the filter media during service operation or backwash. Standard pipe arrangement or an internal valving system will not be acceptable. The upper distribution system shall include a 360 degrees diffuser over the filter bed, and shall be joined to the influent connection by means of Schedule 40 PVC pipe and fittings. The lower collection system shall consist of a slotted lateral design to retain filter media with minimum head loss. The internal collection system shall be designed to promote media bed circulation during backwash.
4. Pressure Gauge Panel: The pressure gauge shall consist of 2½" (63mm) diameter gauge scaled from 0 to 60 PSIG (0 to 400 kPa). The pressure gauge shall be mounted on top of the filter and shall be connected to influent pressure points with air relief cocks.
5. Backwash Valves:
    a. Provide rotary-style multiport valves with manual valve handle.

2.16 FILTRATION MEDIA

A. General
    1. Filter media shall be provided by contractor.
    2. Filtration media shall be manufactured and listed specifically for pool filtration use.

B. Sand Filtration Media
    1. Filter media shall be activated green glass material, bio-resistant, self-sterilizing.
        a. Provide with layers of the following media grades:
            1) Grain 1: 0.4-1.0mm grain size (70% of total media per filter)
            2) Grain 2: 1.0-2.0mm grain size (15% of total media per filter)
            3) Grain 3: 2.0-4.0mm grain size (15% of total media per filter)

2.17 VARIABLE FREQUENCY DRIVES

A. VFD shall be suitable for installation in indoor locations with corrosive gasses present. Unit shall be enclosed in a NEMA 4X enclosure, and VFD internal components shall be completely protected by conformal coatings. Unit shall be suitable for operating temperatures between 32-104°F, with a relative humidity of 90% or less.
    1. VFD's with lower NEMA ratings provided inside a separate enclosure with the above-specified rating shall not be acceptable.

B. Unit shall operate with supply frequencies between 50-60Hz, and shall have an output frequency range of 0-400Hz. VFD shall be rated for 120% overload for 1 minute. VFD shall have a 97% efficiency at nominal full load.

C. Aquatics Controller
    1. VFD shall be provided with aquatics-specific controller. Controller shall have pushbutton or touchscreen interface with digital display. Controller and VFD shall be configured for the following functionality:
        a. Two programmable speeds based on time clock setting.
        b. Constant flow based on flow sensor input.
    2. Aquatics controller shall be NEMA 4X rated.
    3. Aquatics controller may be integrated into common enclosure with VFD and bypass assembly. Interface & display shall be installed on the face of the enclosure, and shall not require opening the enclosure to access the interface.

D. VFD and controller shall be password-protected to prevent unauthorized access.
    1. Unit shall be configured with multiple levels of password-protected access.
    2. Unit shall be capable of having operational range set by factory authorized technician, and password protected so that end user cannot set VFD to run outside of that operational range.

E. Bypass Panel
    1. Provide VFD with 2-contactor bypass panel.
    2. Bypass panel shall be provided with NEMA 4X enclosure.

F. Provide VFD with the following options:
    1. Line reactor.

2.18 VALVES

A. Valves For PVC Systems:
    1. Butterfly Valves: 8” and smaller, Asahi, Hayward, or approved equal, lever operated, V-notch, PVC body, PVC disc, Viton seat, wafer type. Provide with complete flange kit for installation.
    2. Ball Valves: 4” and smaller, Asahi, Hayward or approved equal, true union type with Teflon seat and removable ABS handle, PVC body, socket ends.
    3. Flanges shall be Schedule 80 PVC. Dimensions to conform to ANSI B16.5.

B. Solenoid Valves:
    1. Solenoid Valves (Metallic): The electric remote control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe pattern design with reverse flow configuration. Valves shall fail to closed position in event of diaphragm tear or rip. Valve bodies, cross handles shall be constructed from cast red brass. Valves shall have internal & external manual bleed. Bolts & other hardware shall be stainless steel. Operating diaphragm shall be high-strength molded Buna-N reinforced with mesh nylon, having a tested burst rating of 600 psi. Valve shall include a stainless steel flow control stem. Valve & solenoid configuration shall be completely waterproof to ensure corrosion-free operation.

The valve pressure rating shall not be less than 200 psi. Valve closing speed shall be 0.9-2.0 seconds at 50-100 psi water pressure. Valves shall be Buckner VB series.

C. Manifold Master Valve
   1. General: PVC butterfly valve - Asahi, Hayward, or approved equal, V-notch, PVC body, PVC disc, Viton seat, wafer type. Provide with complete flange kit for installation. Valve shall be configured for electronic actuator installation.
   2. Actuator: Actuator shall be electric type, compatible with spray feature controller signal output. Actuator shall be fully waterproof type.

D. Pressure Maintenance (Pressure Sustaining) Valves:
   1. Hydraulically-operated, pilot-controlled modulating valve design. Main valve body shall be cast ductile iron, with stainless steel trim, Buna-N rubber disc & diaphragm. Provide with complete pilot assembly & all interconnecting tubing & related components required for pressure maintenance operation.

E. Back Flow Preventers:
   1. Backwater Valves:
      a. PVC Backwater Valves
         1) PVC construction with EPDM flapper seal, threaded top for servicing, snap-in flapper assembly, pressure rated to 43 PSI.
         2) Provide with valve extension kit and cap, length appropriate for bury depth of valve.
         3) Conform to ASME/ANSI A112.14.1 for Backwater Valves

PART 3 EXECUTION

3.1 GENERAL

A. Install all components in accordance with the manufacturer's instructions and the applicable codes.

B. All assemblies shall be installed in accurate location (per architectural & pool mechanical design documents), in required location to surrounding finish grade, on footings.

C. Provide all interconnection piping, tubing, wiring or other materials to connect equipment, controls, and all other components for complete & functional systems.

3.2 ELECTRICAL WORK

A. Provide all wiring connections required for operation and control of spray park system components. This scope shall include all interlocks referred to in these specifications or on the drawings or to provide functionality required by the contract documents, as well as wiring connections between field-installed equipment such as control panels,

pumps, VFD's, UV controllers, UV treatment units, water feature activators, water feature solenoid valves, and debris trap & diverter assemblies.

B. Division 26 contractor shall be responsible for electrical power connections to the following components:
   1. Water feature control panel.
   2. Breaker panel at spray park control panel assembly.
   3. Pumps.
   4. Chemical feeders.
   5. UV control panels.

C. Contractor shall be responsible for coordinating line-voltage and bonding installations with Division 26 contractor scope.

D. Field Wiring Required
   1. General: This list is only intended to provide a general idea of the amount of field wiring required, and may not include 100% of the field wiring scope required. Contractor shall be responsible for providing all field wiring for a complete & functional system as noted above. Contractor shall be responsible for providing wire sizing & wiring system design.
   2. Low Voltage
      a. Water feature control panel to feature solenoid valves.
      b. Water feature control panel to feature solenoid valves at water features on spray pad (where applicable).
      c. Water feature activators at spraypad to water feature control panel.
      d. Flow meters (and/or other sensors) to water feature control panel, VFD’s, chemistry control panel, or other control panels.
   3. Line Voltage (120V/1Ph and 208V/3Ph)
      a. Power wiring to breaker panel at skid system.
      b. Power wiring to UV system control panel.
      c. Grounding & bonding for all metal system components in the mechanical room or chemical storage rooms.
      d. Grounding & bonding for all metal system components at the spray pad, including:
         1) Activators.
         2) Water features.
         3) Reinforcing steel in spray pad slab.
      e. Diverter valve control wiring.
      f. Diverter valve open/closed signal input to water feature control panel.

E. The contractor shall be responsible for providing design of all interlocks, wiring connections, piping connections, etc., that are not shown in detail in the contract documents or are not factory-provided in entirety by equipment manufacturer(s).

F. All electrical work shall be permitted with the Authority Having Jurisdiction, and shall be performed by a licensed electrician.

G. All electrical work in spray park mechanical rooms shall be provided per NEC requirements for wet and corrosive areas.
   1. This requirement shall generally apply to all electrical work scope required under this specification for the spray park system(s), unless specifically noted otherwise.

H. All electrical work in chemical storage room(s) shall be provided per NEC requirements for wet and corrosive areas.

I. Wiring & Conduit
   1. All wiring shall be run in conduit. Conduit system and fittings shall be PVC.
      a. Liquid-tight flex connections at equipment locations shall be acceptable.
   2. At contractor option, where allowed by NEC, Division 26 documents, and local requirements, where several similarly-classified (low-voltage or line voltage) wiring is routed similarly, wiring may be routed together in the same conduit.
      a. Increase conduit size where required by NEC, Division 26 documents, or local requirements to accomodate combined wire routing.
   3. Unless noted otherwise, all line voltage wiring shall be #12 AWG copper.
   4. Unless noted otherwise, all low voltage wiring shall be 16/2 copper w/ shielding.
   5. All wiring shall be labelled at both ends to facilitate connections & troubleshooting. Labels shall be typed/printed and adhesive-backed.

J. Grounding Lugs
   1. All equipment and components requiring grounding shall be provided with factory-installed grounding lugs or factory drilled and tapped for field installation of grounding lugs. Spray park contractor shall provide grounding lugs with all equipment and components requiring field-installed grounding lugs.

3.3 VERIFICATION OF EXISTING CONDITIONS

A. Examine all fixtures & components and verify that equipment is undamaged and ready for field assembly. Return damaged and non-conforming products to the manufacturer.

3.4 HOUSEKEEPING PADS

A. Provide concrete housekeeping pads for the following equipment:
   1. Pumps.
   2. Filters.

B. Housekeeping pads shall be constructed of 3000 psig concrete (minimum), with rebar reinforcement throughout pads.
   1. Rebar reinforcement shall be minimum #4 bar.

3.5 PREPARATION FOR SERVICE

A. New systems shall be purged of deleterious matter prior to system activation.

B. The contractor shall inspect the entire system including electronic components in the presence of the Owner's representative.

C. Ensure all spray feature nozzles are adjusted and secured to the satisfaction of the Owner's representative.

3.6 TRAINING & EQUIPMENT STARTUP

A. Provide startup and adjustment services for spray park systems. Startup and adjustment for all systems & equipment shall be performed by spray park system manufacturer's factory representative.
   1. The following specialty equipment (including but not limited to chemistry controllers, UV systems, etc.) shall have startup performed by equipment manufacturer's factory representative:
      a. Chemistry controllers
      b. UV systems
      c. VFD's
      d. Water feature controllers

B. Provide minimum of 8 hours of training for Owner staff. Training shall be performed by spray park system manufacturer's factory representative.

C. Contractor shall have spraypark systems completely installed and ready for factory startup prior to factory startup and Owner training. Contractor shall coordinate with Owner as well as suppliers & other contractors to determine timeframe for startup & training.

D. Contractor shall have spraypark systems completely installed and ready for factory startup prior to factory startup and Owner-scheduled training. Contractor shall coordinate with Owner to determine timeframe for startup & training.

E. Startup process shall include demonstration of all operational modes and functions required in these documents, including but not limited to:
   1. Chemical feed shutdown on loss of water flow.
   2. Diverter operation.
   3. VFD operation.
   4. Recirculation mode operation.
   5. Feature flow operation.
   6. Pretreatment flushout sequence.
   7. Mid-day flushout sequence.

3.7 VALVE INSTALLATION

A. Valves shall be installed with stems horizontal or above horizontal except for ball or butterfly valves, which may be installed with valve stems down.

B. All other practices for valves shall be the same as for the system in which they are to be installed and the valve manufacturer's instructions.

3.8 WATER TREATMENT AND CIRCULATION SYSTEM

A. Install the water treatment system per the manufacturer's instructions. Installation shall include installation of the skid system, feature manifold, piping connections, electrical connections, and installation of the complete water treatment & circulation system including all components shown on the drawings, specified herein, and/or required for complete and functional system(s).

B. Provide all components & programming necessary to interlock pump, VFD, UV system, and spray feature control panel for functional system operation, including changing modes between normal operation & backwash, etc.).

3.9 WATER FEATURE ACTIVATORS

A. Activators with detach-and-exchange type flange mounts shall be installed so that top surface of flange on water feature and top of winterization cover plate shall be completely flush with adjacent surface (spray pad).

B. Provide electrical grounding & bonding for all water feature activators. Grounding & bonding materials & methods shall be per electrical specifications for grounding & bonding. Contractor shall provide design & layout for grounding & bonding systems.

C. Electrical connections for all water feature activators shall be provided in conduit and shall be completely watertight.

D. Electrical wiring inside post-mounted, feature-mounted, or bollard-type water feature activators shall be run in conduit and shall be completely watertight.

E. Provide water feature activator manufacturer's recommended footings & mounting components for all post-mounted, feature-mounted, or bollard-type activators. Mounting hardware shall be tamper resistant stainless steel.

3.10 WATER STORAGE TANK

A. Install the water storage tank system per the manufacturer's instructions. Installation shall include fabrication & installation of the tank anchorage system, installation of concrete around the tank access hatch, installation & compaction of backfill material, electrical connections, and piping connections.

B. Installation shall be suitable for traffic rated areas. Traffic rating shall meet AASHTO HS20 standards. Provide all installation method(s), components, etc., required by tank manufacturer to meet traffic rated installation requirements.

C. Contractor shall provide shoring as required to install tank in location indicated on drawings while protecting existing adjacent building.

D. Tank shall be installed slightly sloped towards bottom drain location, to facilitate drainage.

E. Piping connections at water storage tank (including couplings) shall be pressure tested and proven to be leak-free prior to burial.

3.11 DEBRIS TRAP SYSTEM

A. Install the debris trap system per the manufacturer's instructions. Installation shall include installation of the vault & foundation, piping connections, electrical connections, and installation of the diverter valves & strainer.

B. Installation shall be suitable for traffic rated areas. Traffic rating shall meet AASHTO HS20 standards. Provide all installation method(s), components, etc., required by debris trap manufacturer to meet traffic rated installation requirements.

3.12 FILTERS

A. Contractor shall provide filtration media for sand filters.

3.13 STRAINERS

A. Wye-strainers shall be installed so that end caps & strainer elements are accessible for maintenance.

3.14 VARIABLE FREQUENCY DRIVES

A. Warranty: Provide VFD warranty, for one year from date of startup. Warranty shall include parts, and labor allowance for repair hours.

B. Examination
   1. Verify that surface is suitable for VFD installation.
   2. Do not install VFD until the building environment can be maintained, within the service conditions required by the manufacturer.

C. Installation
   1. Install VFD where indicated, in accordance with manufacturer's written instructions and NEMA ICS 3.
   2. Tighten accessible connections and mechanical fasteners after placing VFD.
   3. Provide a nameplate label on each VFD, identifying rated horsepower, full load amperes, model number, service factor and voltage/phase rating.

D. Field Quality Control
    1. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

E. System Startup & Commissioning
    1. Provide the services of a qualified manufacturer's employed Field Service Engineer to assist the Customer the start-up and commissioning of the equipment specified under this section. Field Service personnel shall reside within the State in which the specified equipment is being installed and be factory trained with periodic updates and have experience with the same model of VFD on the job site. Sales representatives will not be permitted to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Customer in general assembly of the equipment, installation as specified in manufacturer’s installation instructions, wiring, application dependant adjustments, and verification of proper VFD operation.
        a. The manufacturer’s service representative shall perform the following minimum work:
            1) Inspection and final adjustments.
            2) Operational and functional checks of VFD.
    2. Adjustments
        a. Adjust the VFD settings to meet project design & performance requirements.
        b. Coordinate with balancing contractor & spray park installer to test water circulation systems once installation is complete. If circulation system flows above maximum allowed by code when VFD is set to 100% speed setting, the following steps shall be taken:
            1) Startup technician shall set minimum & maximum limits for VFD adjustment to ensure that recirculation system will not flow over maximum gpm allowed by code.
            2) Startup technician shall lock minimum & maximum limits for VFD adjustment by setting password.
                (a) Password for this access level shall not be given to Owner.
        c. Coordinate with Owner's Representative to determine maximum gpm flow allowed by code.

F. Configuration
    1. VFD's shall be configured to maintain constant water flow based on flowmeter signal when pool system is in recirculation mode.

3.15 MANUFACTURER REPRESENTATION

A. Manufacturer’s representative shall provide on-site visits at 1, 2, and 6-month intervals following completion of construction for spray pad water treatment & circulation systems as part of this contract.

B. Spray park system manufacturer shall provide a local contact for service & support. Local contact office shall be within 500 miles of project site.

END OF SECTION

SECTION 13 15 13

SPRAY PARK PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. PVC pipe & fittings.

B. HDPE pipe & fittings.

1.2 REFERENCE STANDARDS

A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.

B. ANSI B16.5 - Pipe Flanges and Flanged Fittings

C. ASTM D1784 - Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

D. ECEI BS EN 61000 - Electromagnetic Compatibility, Generic Emission Standard, Residential, Commercial, and Light Industry

E. IAPMO Uniform Plumbing Code (UPC)

F. ISO 9001 - Quality Management Systems

G. NSF Standard 50 - Equipment for Pools, Spas, Hot Tubs, and Other Recreational Water Facilities

1.3 SUBMITTALS

A. Manufacturer's product data.

B. Project Record Documents: Provide a complete set of as-built drawings with actual locations of components & piping, including depth/elevations.

1.4 QUALITY ASSURANCE

A. Suppliers: Equipment & accessories shall be designed, fabricated, installed and tested by a manufacturer with a minimum of 5 years’ experience and at least 10 projects of similar size and scope.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage & handling requirements.

B. Use all means necessary to protect the materials of this section before, during and after installation. The installer shall carefully inspect all material before beginning work and report any damage to the Owner's representatives before using said material. Any contractor-provided materials found to be unacceptable will be replaced at no cost to the Owner.

C. All protective wrappings are to be left intact through installation and then removed upon completion.

1.6 CLOSEOUT REQUIREMENTS:

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. All spray park specialty components shall be NSF certified.

B. Provide all necessary components for a complete system. Some of these components may be shown only on the Plans, but shall be provided under this Specification.

2.2 PVC PIPE AND FITTINGS

A. Pipe: PVC, Type-1, Grade 1, ASTM D-1785; Schedule 80.

B. Fittings And Flanges: ASTM D2467 (Schedule 80 socket) to match pipe system.

C. Use flanges for metal to plastic connections with teflon bonded EPDM-AV gaskets to provide bubble tight sealing. Maximum bolt torque shall not exceed manufacturer's recommendations.

D. Solvent Cement For PVC: Weld-On 711 gray cement, or approved equal, IAPMO-UPC and NSF listed, ATSM D-2564.

E. Primer for PVC: Weld-On P70 purple primer, or approved equal, IAPMO-UPC and NSF listed, ASTM F-656.

F. The Contractor shall demonstrate proficiency in solvent welding to the satisfaction of the Owner's representative. Follow strictly the manufacturer's published instructions covering the recommended procedures for installing thermoplastic piping systems, including above ground installation, below ground installation, and including complete sand embedment, handling and storage of piping.

2.3 HDPE PIPE AND FITTINGS

A. High Density Polyethylene (HDPE) manufactured from a virgin polyethylene extrusion compound in accordance with ASTM D-2513, Sections 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D-3035, D-2447, or F-714. Pipe shall maintain a 1600 PSI Hydrostatic Design Basis at 73.4°F per ASTM D-2837, and shall be listed per PPI TR4 as PE3408 piping formulation, having a cell classification of PE345434C or PE355434C with a UV stabilizer of C, D, or E as specified in ASTM D-3350 with the following exception: This material shall exhibit zero failures (F0) when tested for 192 or more hours under ASTM D-1693, condition C, as required in ASTM D-3350. Pipe dimension ratio (SDR) shall be 11 for pipe sizes 2" or less, and 13.5 or ASTM D-2447 (Schedule 40) for sizes greater than 2". Pipe size 3" and larger shall be SDR 17 per ASTM D-3035, D-2447, or F-714. Pipe shall be marked in accordance with the appropriate ASTM pipe standard. The pipe shall be warranted by the manufacturer with a written warranty of minimum 25 years, specifying material and labor allowance.

B. Supports: Provide per Uniform Plumbing Code chapter 3.

PART 3 EXECUTION

3.1 GENERAL

A. Install all components in accordance with the manufacturer's instructions and the applicable codes.

B. Provide all inter connection piping, tubing, wiring or other materials to connect control or measurement components.

3.2 SYSTEMS

A. Mechanical room piping: PVC

B. Feature supply piping: PVC or HDPE

C. Drain piping, spray park to diverter: PVC

D. Drain piping, diverter to tank: PVC

3.3 PVC PIPE INSTALLATION

A. General: Install piping per plumbing code in force by the Authority Having Jurisdiction; include any referenced installation standards.

B. Mechanical Joints: Mechanical joints shall be installed in accordance with the manufacturer's instructions.

C. Solvent Cementing: Joint surfaces shall be clean and free from moisture, and an approved primer shall be applied. Solvent cement, shall be applied to all joint surfaces.

The joint shall be made while the cement is wet, and in accordance with ASTM D 2846 or ASTM F493. Solvent cement joints shall be permitted above or below ground.

D. Joints Between Different Materials: Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical sealing type. Connectors or adapters shall have an Elastomeric seal conforming to ASTM D1869 or ASTM F477. Joints shall be installed in accordance with the manufacturer's instructions. Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting.

E. Water Stops: Provide water stops at all spray pad deck connections and/or where recommended by spray pad equipment manufacturer.

F. Pressure Tests:
   1. All pressure tests shall be witnessed by the Architect and any defects corrected to his satisfaction.
   2. Pressure piping:
      a. Test systems at 50 PSI for 2 hours without loss of pressure.
   3. Gravity drain & non-pressurized piping:
      a. Test systems at 5 PSI for 24 hours without loss of pressure.

3.4 HDPE PIPE INSTALLATION

A. General: Install piping per plumbing code in force by the Authority Having Jurisdiction; include any referenced installation standards.

B. HDPE piping shall be continuous, without fittings from spray feature manifold to each water feature.
   1. Where multiple features are supplied from a single valve & main supply line, joints shall be allowed.

C. Mechanical Joints: Mechanical joints shall be installed in accordance with the manufacturer's instructions.
   1. Mechanical joints shall only be allowed at connections to water features, or above grade at water feature manifold.

D. Fusion Joints: Join piping sections & fittings using pipe & fitting manufacturer's fusion joint system.

E. Joints Between Different Materials:
   1. Joints between HDPE and PVC or CPVC systems shall be made using stainless steel threaded HDPE adapter with fusion weld butt joint on HDPE end and male thread fitting on other end. A PVC adapter (female thread x PVC slip) shall be used to connect to the PVC piping.The threaded pipe connection shall be made before the PVC slip pipe connection is made.

F. Water Stops:
   1. Provide water stops at all spray pad deck connections and/or where recommended by spray pad equipment manufacturer.
   2. Provide pipe flange waterstops where pipes penetrate concrete walls of water containing pits, sumps, or tanks.

G. Pressure Tests:
   1. All pressure tests shall be witnessed by the Architect and any defects corrected to his satisfaction.
   2. Pressure piping:
      a. Test systems at 50 PSI for 2 hours without loss of pressure.
   3. Gravity drain & non-pressurized piping:
      a. Test systems at 5 PSI for 24 hours without loss of pressure.

3.5 PREPARATION FOR SERVICE

A. Completely purge all deleterious matter from the following systems:
   1. New or modified systems.

B. Systems shall be flushed with the following:
   1. Fresh water.
   2. Phosphate remover, such as Orenda PR-10,000.
   3. Enzyme water cleaner. such as Orenda CV-600.
   4. Ascorbic acid for metal and stain removal.

END OF SECTION

SECTION 13 15 16

SPRAY PARK PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pumps.

1.2 REFERENCE PUBLICATIONS

A. AISI 1045 - Cold Drawn Carbon Steel Bar, Type 1045

B. AISI 416 - Stainless Steel, Type 416

C. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

D. ASTM A48 - Gray Iron Castings

E. ASTM B62 - Composition Bronze or Ounce Metal Castings

F. NSF Standard 50 - Equipment for Pools, Spas, Hot Tubs, and other Recreational Water Facilities

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product submittals.

1.4 QUALITY ASSURANCE

A. Suppliers: Equipment & accessories shall be designed, fabricated, installed and tested by a manufacturer with a minimum of 5 years' experience and at least 10 projects of similar size and scope.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Use all means necessary to protect the materials of this section before, during and after installation. The installer shall carefully inspect all material before beginning work and report any damage to the Owner's representatives before using said material. Any contractor-provided materials found to be unacceptable will be replaced at no cost to the Owner.

C. All protective wrappings are to be left intact through installation and then removed upon completion.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Head-capacity curves shall slope up to maximum head at shut-off. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Provide self-priming pumps for open systems, and insure that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).

B. Pump Driver: Furnish with pump. Size to be non-overloading at any point on the head-capacity curve including one pump operation in a parallel or series pumping installation.

C. Overload Protection: Furnish external thermal overload protection for all pumps. Size per pump & motor manufacturer’s recommendations.

2.2 CENTRIFUGAL PUMPS, SELF-PRIMING

A. Plastic, Close-Coupled, End Suction Type:
   1. Base-mount, single-stage, centrifugal end-suction type with suction & discharge flanges for pipe connections.
   2. Pump housing shall be constructed of high-performance, corrosion-resistant THK plastic.
   3. Impeller shall be constructed of high-performance, corrosion-resistant THK plastic.
   4. Motor shall be TEFC type with sealed ball bearings, with Class F insulation and IP55 rating.
   5. Shaft couplings shall be provided that allow the motor to be replaced without replacement of the mechanical seal.
   6. Mechanical seal shall be carbon/SIC-EPDM type.
   7. Shaft extension shall be stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's instructions for pump mounting and startup.

3.2 STARTUP

A. Verify that the piping system has been flushed, cleaned and filled.

B. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

C. Perform field mechanical balancing if necessary to meet specified vibration tolerance.

END OF SECTION

SECTION 13 15 19

SPRAY PARK WATER TREATMENT EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Chemical controllers and accessories.

B. Chemical sensors.

C. Solid chlorine feed systems.

D. Gas CO2 systems.

E. Ultraviolet water treatment systems.

F. Chemical lockers.

1.2 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Manufacturer's product data.

C. Record documents.

1.3 QUALITY ASSURANCE

A. Suppliers: Equipment & accessories shall be designed, fabricated, installed and tested by a manufacturer with a minimum of 5 years' experience and at least 10 projects of similar size and scope.

1.4 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Use all means necessary to protect the materials of this section before, during and after installation. The installer shall carefully inspect all material before beginning work and report any damage to the Owner's representatives before using said material. Any contractor-provided materials found to be unacceptable will be replaced at no cost to the Owner.

C. All protective wrappings are to be left intact through installation and then removed upon completion.

1.5 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 CHEMISTRY CONTROLLERS

A. General:
   1. The water chemistry control system shall provide continuous monitoring and control of sanitizers (standard ORP probe), oxidizers, pH, temperature and water chemistry balance calculations.
   2. Installation of the complete system shall be per the manufacturer's specification and no exceptions shall be allowed.
   3. Remote access shall be provided through EZConnect, without the need for port forwarding or a VPN.

B. Certifications:
   1. NSF/ANSI Standard 50
   2. UL 61010-1
   3. (CSA) C22.2 Number 61010-1
   4. European Union Low Voltage Directive 73/23/EEC EN 61010-1

C. User Interface:
   1. The standard display shall be a backlit transflective LCD with 14 line x 40 alpha/numeric graphical characters that will continuously display information related to the following:
      a. All installed sensor readings,
      b. Set points, with current control status,
      c. All active alarms, including time activated,
      d. Smart menus w/ integrated on-screen help.
   2. Contrast adjustment of the backlit LCD shall be provided through clearly marked keys on the front-panel without the need for access to internal controller circuitry. After initial adjustment, controller shall monitor internal temperature and automatically adjust contrast to prevent LCD blackout in extreme ambient temperature conditions. Controllers that do not include front-panel contrast adjustment and automatic temperature compensation shall not be considered equal.
   3. The standard user interface shall include single-touch access to Set Points, Relay Modes, Calibrations, Menu access, and Reset Fail/Safes. An alphanumeric keypad shall be provided for ease of system configuration.

D. Control Functions:
   1. Water Chemistry
      a. pH Control: The controller shall continuously control pH. Chemical feed shall be configurable for feed-up, feed-down, or dual feed and either on/off or time-based proportional feed.

b. Sanitizer Control: The controller shall continuously control sanitizer based upon the ORP reading, the free chlorine sensor, or both with a bracketed control program. Chemical feed shall be configurable for either on/off or time-based proportional feed.
c. Bracketed Sanitizer Control: With a free chlorine sensor, the controller shall be configurable for bracketed sanitizer control; The bracketed control algorithm shall allow either the ORP or ppm set point to be chosen as the primary control point, while using other parameter to create a secondary boundary (min and max settings) that must be maintained in addition to the primary control point.
d. Sanitizer Booster Feed: The controller shall have a sanitizer booster program with selectable ORP and/or ppm set points with separate ending set points, allowing the option of the booster sanitizer to control to a lower set point while the primary system can recovers.
e. UV Control: A Fireman Cycle feature shall turn off (ramp down) the UV relay 0 to 60 minutes (settable) prior to backwash initiation or recirculation pump shutdown.
f. Ozone/Auxiliary: A Fireman Cycle feature shall turn off (ramp down) the Ozone/Auxiliary relay 0 to 60 minutes (settable) prior to backwash initiation or recirculation pump shutdown. The Ozone Fireman control and relay shall have the ability to be renamed in the menus to provide the Fireman Cycle feature for Auxiliary equipment instead of ozone as needed.
g. Combined Chlorine UV Control: With free and total chlorine sensors, the controller shall provide turndown control of a UV system based upon combined chlorine set point; when combined chlorine is below set point the UV system will be turned down to decrease energy consumption and extend bulb life.
h. Superchlorination: The controller shall have a programmable superchlorination function, based upon ORP or ppm superchlor setpoint, which is triggered manually.
i. Dechlorination: The controller shall have a programmable dechlorination function, based upon ORP or ppm dechlor setpoint, which is triggered either manually or by the completion of the superchlorination function.
j. LSI & RSI: The controller shall compute the Langelier Saturation Index and the Ryznar Saturation Index based upon current inputs and the Ca Hardness and Alkalinity entered by the operator.

2. Expanded Functions:
   a. Flow Monitoring: With a circulation flow sensor, the controller shall continuously monitor, display, and datalog system flow, maintaining a total flow volume. A Low Flow Alarm shall be operator settable, which can be programmed to disable chemical feeds. Controller shall also have a Minimum

Flow Rate setting to turn off heater whenever system flow is less than this programmed minimum level.

b. Heater Control: The controller shall perform on/off control of a heater based upon an operator settable temperature set point. A Fireman Cycle feature shall turn off the Heater 0 to 60 minutes (settable) prior to recirculation pump shutdown. The controller shall immediately turn off the Heater when system flow is less than the heater Minimum Flow Rate setting. The Heater control algorithm shall include an Energy Conservation mode, with on/off set time and secondary temperature set point.

c. TDS Control: With a conductivity/TDS sensor, the controller shall provide selectable control of TDS through simultaneous draining of water prior to filtration and addition of fresh make-up water.

d. Enzyme Feed: The controller shall include a programmable daily timed feed with start and end time, feed duration, and number of cycles to allow multiple feed cycles per day.

e. Turbidity Control: With a turbidity sensor, the controller shall feed polymer based upon turbidity setpoint.

f. Chemical Inventory Monitoring: With an acid and/or liquid chlorine level sensor, the controller shall continuously monitor, display, and data log liquid pH adjuster and chlorine inventory levels. The controller shall include low chemical level alarm points for each chemical being monitored.

g. Backwash Tank Monitoring: With a backwash tank level sensor, the controller shall continuously monitor, display, and data log backwash holding tank level.

h. Surge Tank Monitoring: With a surge tank level sensor, the controller shall continuously monitor, display, and data log surge tank level.

i. Autofill: With a surge tank level sensor, the controller shall automatically control a water makeup relay to add makeup water to maintain pool level set point, based upon surge tanks (or equivalent) level, with an overfill delay feature. The controller shall provide a programmable alternate set point (4 event 28 day timer).

j. Main Drain Modulating Valve Control: With a surge tank level sensor and electronically controlled main drain valve, the controller shall continuously modulate (control) the main drain valve via a 4-20 mA output signal. Two user-defined settings shall specify the range of modulation of the main drain valve, with the control signal scaled linearly between those two points.

3. Energy Conservation

a. Alternate Setpoints: The controller shall have alternate Sanitizer, Heater, and Autofill setpoints, based upon a 4 event 28 day timer.

1) Energy Conservation Mode: The controller shall have the capability to disable all mechanical and chemical functions during programmed conservation cycle. The Energy Conservation Mode shall include the

ability to periodically monitor and satisfy all operation requirements based upon a programmed time schedule.

4. Main Recirculation Pump
    a. On/Off Control with Relay
        1) Controller shall provide the capability to interface to and control a recirculation pump with a programmable relay. The controller shall provide 3 operator-settable independent Fireman Cycle settings and relays for the Heater, UV and Ozone/Auxiliary controls.
        2) The controller shall include the following capabilities, available as appropriate based upon installed sensors and implemented features:
        3) Fireman Cycle: Upon the following events, the controller shall automatically delay recirculation pump shutdown until the Heater, UV and Ozone/Auxiliary controls have been deactivated and the corresponding Fireman Cycles have expired:
            (a) Backwash Operations
                (1) Energy Conservation mode (24 hr, 7 day function)
                (2) Manual off (per Operator)
        4) Immediate: Upon the following events, the controller shall immediately turn off the recirculation pump (and Heater, UV and Ozone/Auxiliary controls), without first satisfying Fireman Cycle timing requirements:
            (a) Surge Tank Level Low Alarm: Turn off pump immediately (surge tank is almost empty)
                (1) Strainer Vacuum High Alarm: Turn off pump immediately (possible entrapment)
                (2) Emergency shut down, triggered by front-panel Emergency Off: Turn off pump immediately (per Operator)
    b. Total Dynamic Head (TDH)
        1) Controller shall provide the capability to continuously monitor the Total Dynamic Head (TDH) of the main recirculation pump, directly calculated by the controller from recirculation pump influent vacuum and filter influent pressure transducers (if installed). TDH shall be displayed on the user interface and recorded in data logs, with user-programmable High and Low TDH Alarm settings.
    c. VFD Interface
        1) Controller shall provide the capability to interface to and control a recirculation pump equipped with a Variable Frequency Drive (VFD) through a 4-20mA signal. The controller programming shall allow the operator to manage the VFD entirely from the water chemistry controller, by providing the following capabilities:
            (a) Programmable setpoint specified as either flow rate, effluent filter pressure, or fixed setting,

(1) Four programmable operator-triggered alternate profiles ("Manual Turndowns"),
(2) Four programmable scheduled alternate profiles ("Scheduled Turndowns"),
(3) Override setting for backwash,
(4) Ramp up and ramp down settings,
(5) Minimum output setting.

2) The controller shall automatically abort a Manual or Scheduled Turndown upon declining water chemistry and return to the standard programmed circulation rate to maintain optimal water quality. Declining water chemistry is signaled by any of the following alarm conditions:
(a) pH low alarm
(1) pH high alarm
(2) ORP low alarm
(3) ORP high alarm
(4) PPM low alarm
(5) PPM high alarm
(6) Temperature low alarm
(7) Temperature high alarm
(8) Total Cl High alarm
(9) Combined Cl High alarm
(10) Turbidity high alarm

3) During a VFD turndown the controller shall automatically increase the circulation flow rate to satisfy minimum flow rate requirements for a heater, UV and/or ozone unit. Each device shall have a dedicated minimum flow rate setting; when the controller logic determines that one of these units must be activated to achieve the programmed set point, the controller shall automatically increase the circulation flow rate (if necessary) while that device is activated. After the set point is satisfied, the controller shall return to the flow rate specified in the VFD turndown after any programmed Fireman's Cycles have elapsed.

4) Remote access to current VFD status and all VFD parameters shall be provided through the BECSys for Windows PC software provided with controller. The name of each alternate profile shall be changeable by the operator, so that VFD menus and data log entries are intuitive and recognizable by the users of the system.

5) Systems that do not provide both local and remote management of the VFD through the water chemistry controller shall not be considered equal.

E. Control Outputs
1. Relay Outputs

a. Solid-State Relays
    1) The controller shall come with a total of 4 integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions, accounting for the effects of the temperature gradient inside the NEMA 4X enclosure. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity. All solid-state relays shall have a provision for an electrical interlock with the circulation pump motor starter.

2. Expansion Relay Outputs
    a. Solid-State Relay Expansion Modules
        1) Each Solid-State Relay Expansion Module shall provide 5 integral 5A solid state dry contact or line powered relays capable of switching 3A under all normal operating conditions. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity. All solid-state relays shall have a provision for an electrical interlock with the circulation pump motor starter.
    b. Mechanical Relay Expansion Modules
        1) Each Mechanical Relay Expansion Module shall provide 5 integral mechanical relays:
            (a) 1 integral 8A dry contact mechanical relay
            (b) 4 integral 3A dry contact or line powered mechanical relays.
        2) Since mechanical relays have the inherent risk of failing in the closed (active) position, as a safety measure the controller shall preclude the ability to assign any of the integral mechanical relays to chemical feed functions. Systems that do not preclude mechanical relays from being configured for chemical feeds shall not be considered equal.
        3) All mechanical relays shall have a provision for an electrical interlock with the circulation pump motor starter.
3. 4-20mA Outputs
    a. The controller shall come with eight separately isolated 4-20mA output signals with a load capacity of 440 ohms per output channel.
    b. Each output signal shall be independently configurable for either of the following functions:
        1) Any enabled input, scaled between two operator-defined end points,
            (a) VFD control of recirculation pump,
            (b) Control of main drain modulating valve.

F. Safety Features
1. Manual-On limit

a. The controller shall have built-in limits to the amount of time any relay control output may be forced on (i.e. in “Manual On” mode). This is an important safety feature to prevent control outputs from inadvertently being left forced on after service or diagnostics.

2. High/Low Alarm Settings & Control Lockouts
   a. The controller shall have programmable high and low alarm settings for pH, ORP, PPM, temperature, low flow & no flow and chemical overfeed, turbidity, pressure & vacuum, surge tank levels, chemical inventory.
   b. The controller shall have a programmable lockout of sanitizer feed upon pH high or low alarm.
3. No Flow Alarm & Flow Restored Delay
   a. The controller shall activate a No Flow alarm when the dedicated sample stream flow switch indicates there is insufficient flow through the sample stream. This No Flow alarm shall lockout all chemical feed control operations.
   b. The controller shall include a Flow Restored Delay, which shall extend the No Flow lockout user-programmable amount of time after the No Flow alarm ends (i.e. flow is restored). This feature is necessary to assure that the system has valid, stable sensor readings of circulating water prior to making chemical feed control decisions.
4. Feed Limit Alarms
   a. The controller shall trigger a FailSafe alarm if a chemical feed relay remains on longer than the programmable Feed Limit Timer. Chemical feeds shall automatically be disabled if the corresponding reading goes into a FailSafe alarm condition.
5. Emergency Off
   a. The controller shall have a dedicated Emergency Off button on the front panel of the system, which immediately halts all chemical feeds and control outputs when pressed. This feature shall be password protectable, which shall require entry of one of the Security passwords.
6. Safety shield
   a. The controller shall include a safety shield that precludes access to high voltage circuitry and wiring. Fuses shall be replaceable without removal of the safety shield.

G. Security
   1. The controller shall have three security password levels: six for operators, two for managers and one for the distributor providing for a history of access identified by the user.

H. Local Alarms Indicators
   1. The controller shall signal all alarm conditions with the following indicators:
      a. a bright red flashing LED on the front of the controller,

b. activation of a master alarm signal provided as a dry contact relay enabling the use of 0-240 VAC alarms, and
c. each active alarm listed on the LCD display along with time activated.

I. Remote Communication, Data Logging, Access & Alarm Notification
1. Gigabit Ethernet with EZConnect
a. The controller shall come with an integral 1 Gbit Ethernet connection. Through this Gbit Ethernet connection the controller shall be capable of providing
b. Local and remote Access via PC,
c. Local and remote Mobile Access with an Android and iPhone Mobile App, and
d. Alarm Notification via email or text message via an Ethernet connection to the Internet.
e. The controller shall have 512 MB NAND flash memory, which does not require a battery to preserve data logs during power outages, for input level recording and events. All input levels shall be recorded and maintained for 365 days on the controller, with a sample taken every minute. The controller shall record and maintain the events over the last 365 days recording all alarms, parameter changes, user logins, and operational cycles related to all control features. Systems that require a battery to preserve data logs during power outages shall not be considered equal.
f. Local and remote access shall be available through the BECSys EZConnect system. The EZConnect system eliminates the need for IT departments to make special router/firewall allowances for access to the controller from outside the network, such as port forwarding and VPNs. Controllers that require a VPN or port forwarding for remote access shall not be considered equal. Messages to/from the controller shall be protected with TLS encryption for maximum security. EZConnect shall be disableable, in which case traditional IP-based techniques can be used to access the controller.
2. Wi-Fi
a. The controller shall come with a BECSys Wi-Fi module, which allows wireless integration into existing Wi-Fi networks.
3. Remote Access
a. The controller manufacturer shall provide BECSys for Windows graphical remote operation software, for interactive connection to the controller from a PC. Remote operation software shall be Windows 10 compatible, and have all of the following operational modes:
1) Site Data Base - for organizing and accessing multiple controllers on site, or at multiple sites.
2) Graphical Operator's Console - to display current readings, setpoints, alarm points and control status in an easy-to-read graphical mode.

3) Data Log Graphing - to review data logs with time-synchronized event data; data log traces shall be configurable, with color and line style selectable by operator.
4) Full Menu Tree - All system parameters accessible through a full menu tree interface.
5) Auto-Polling - to allow automatic download of data logs from all controllers in site database.

4. Mobile App
   a. The controller manufacturer shall provide BECSys Now! Mobile App for monitoring controllers from mobile devices. The Mobile App shall run on Android smartphones and tablets and also iPhones, iPads and iPod Touch devices. The Android App shall be available to download free of charge from Google Play. The IOS App shall be available to download free of charge from the Apple App Store. The App shall include a Quick Status screen, displaying the status (Alarm, No Alarm, or Disconnected) of all controllers monitored by the user. Systems providing mobile access with a web page hosted on the controller shall not be considered equal, as this approach does not support a single-screen Quick Status display of all controllers monitored by the user.
5. Alarm Notification
   a. The controller shall be capable of providing alarm notification to 8 different recipients. Each recipient shall be individually configurable to receive alarm notification by one of the following methods.
   b. Email: Notification message shall include system type, serial number, location, system ID, all active alarms including the date and time each alarm was triggered, and current readings.
   c. Text Message: Notification message shall include system type, serial number, location, system ID, and all active alarms including the date and time each alarm was triggered.

J. Enclosure
1. Controller enclosure
   a. The controller shall be housed in a NEMA 4X polycarbonate enclosure.

2.2 SENSORS

A. General: The controller shall be provided with the following sensors:
1. pH Sensor
   a. 0-14 sensing range.
   b. ABS body with ½" NPT process connection.
   c. Minimum of 32 milliliters of inorganic electrolyte gel. Organic electrolytes, susceptible to breakdown in the presence of strong oxidants, shall not be considered equal.

d. Porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction.
e. Silver/silver chloride (Ag/AgCl) reference element.
f. General purpose glass membrane pH sensing element.
g. Operating temperature range of 0 - 80 degrees C.
h. Operating pressure range of 0 - 100 PSIG.

2. ORP Sensor
   a. -1000 to +1000mV sensing range.
   b. ABS body with ½" NPT process connection.
   c. minimum of 32 milliliters of inorganic electrolyte gel. Organic electrolytes, susceptible to breakdown in the presence of strong oxidants, shall not be considered equal.
   d. Porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction.
   e. Silver/silver chloride (Ag/AgCl) reference element.
   f. Platinum or gold ORP sensing element with a minimum of 1 cm2 surface area.
   g. Operating temperature range of 0-80 degrees C.
   h. Operating pressure range of 0-100 psig.
3. Free Chlorine Sensor
   a. 0.0 to 10.0 mg/l (ppm) measuring range.
   b. 32° - 176°F operating temperature range.
   c. Replaceable cleaning beads.
   d. Solid copper cathode.
   e. Platinum anode.
   f. The sensor shall not utilize a membrane or electrolyte.
4. Liquid Level Sensor
   a. Insertion type level sensor with piezoresistive pressure measurement of vessel liquid levels. Sensor shall be factory-calibrated.
5. Flow Cell:
   a. Lighted Flow Cell
      1) The flow cell shall have a polyethylene body with two ½" NPT ports for pH and ORP sensors, two ¼"NPT ports for temperature sensor and sensor wash acid injection, integrated flow switch and clear acrylic front viewing windows. The flow cell shall also include a port for the CP-1 free chlorine sensor, if present. The flow cell shall be backlit to support inspection of sensors, and red LEDs shall illuminate to indicate a No Flow condition. The flow cell design shall provide precise sample flow rate and water velocity regulation past the sensors. The flow cell shall come provided with PVC ½" isolation ball valves and PVC ¼" wet test valve.
      2) Temperature Sensor
         (a) 32 - 212°F (0 - 100°C) sensing range.

(b) 2 wire, 100-ohm resistive temperature detector (RTD) with a 0.00385 Alpha.

3) Pressure Guage

(a) The pressure sensor shall consist of a compound pressure/vacuum gauge manufactured in stainless steel, 2½" diameter, liquid filled with an operating pressure range of 0-60 psig and vacuum of 0 to -30 in./ Hg.

B. Warranty:

1. Standard sensors shall be covered by a standard manufacturer's 5 year warranty.
2. ORP and pH sensors shall be covered by standard manufacturer's 2 year warranty.
3. Other sensors and flow cell components shall be covered by a standard manufacturer's 1 year warranty.
4. One year on-site warranty service by factory-trained and authorized representative shall be included.

2.3 LIQUID CHLORINE SYSTEMS

A. Injectors: Bypass line mounted injectors for liquid chlorine shall mix and diffuse liquids into swimming pool water stream.

B. Liquid Feed Pump: Peristaltic metering pump with capacity as indicated on the drawings. Provide with check valve to provide back-siphonage.

C. Tubing: Provide high density thick-wall polyethylene tubing, or other material as recommended by the chemistry control equipment manufacturer.

D. Piping: Schedule 80 PVC, ASTM D 1785, Type-1, Grade 1.

E. Liquid Chemical Tanks:

1. Not provided under this contract.

2.4 CARBON DIOXIDE PH CONTROL SYSTEMS

A. Carbon Dioxide Pressure Regulator: One-tank pressure regulator/manifold assembly to control carbon dioxide from 800 PSI to between 50 and 60 PSI. Regulator shall include high pressure braided wire connecting tubing from carbon dioxide cylinders to pressure regulator.

B. Injectors: Bypass line mounted injectors for carbon dioxide shall mix and diffuse gasses into water stream.

C. Carbon Dioxide Control Unit: Unit shall control flow rate and shall cycle carbon dioxide on and off. Unit shall consist of a pressure reducing valve, feed unit with rate of flow adjustment (0 to 30 standard cubic feet per hour), check valve, and high density

polyethylene tubing between pressure regulator and control unit. Unit shall be pressure rated to 100 PSI.

D. Tubing: Provide high density thick-wall polyethylene tubing, or other material as recommended by the chemistry control equipment manufacturer.

E. Piping: Schedule 80 PVC, ASTM D 1785, Type-1, Grade 1. Provide this piping between the control panel and sensor, to the extent recommended by the control panel manufacturer.

F. Gas Supply:
   1. Not provided under this contract.

2.5 ULTRAVIOLET (UV) WATER TREATMENT SYSTEMS

A. The spray park system water shall be routinely monitored and treated by UV sterilization in the range of 220nm to 400nm to kill bacteria, viruses, molds and their spores and to continuously remove chloramines.

B. The UV System shall be a complete unit with all necessary controls. The control panel and UV chamber shall be capable of being installed up to 300 feet apart. The system shall be preassembled and controls packaged and shall include:
   1. UV chamber with flow and output safety control.
   2. UV medium pressure arc tube modified to emit UV light from 220nm to 400nm.
   3. Automatic, adjustable, electric motor-driven quartz sleeve cleaning system.
   4. Operational and power controls.

C. UV Chamber:
   1. The UV chamber shall be pressure rated for continuous operation at 150psi tested to 225psi and constructed of type 316L stainless steel. It shall be designed for an internal pressure drop not to exceed 2psi at maximum flow. The chamber shall incorporate:
      a. A temperature sensor to shut off the UV arc tube when there is inadequate flow in the chamber;
      b. An UV intensity monitor which alarms when the UV arc tube output drops below the dosing level required for proper operation. The monitor shall be of the wet probe type wavelength specific to 240nm - 280nm with a 4-20mA output. It shall display actual lamp intensity (mW/cm2) on the control cabinet door display. Dry probe monitors shall not be acceptable, as this type cannot be wiped during the automatic wiping action. Direct line of site monitors (ie those types that have the sensor directly exposed to UV light) shall not be permitted. The monitor shall use offset filters to extend monitor life and to ensure only a limited band of wavelengths is measured.

c. A stainless steel terminal cover fastened to the chamber end plate, to which is affixed the electrical conduit, to protect the lamps and electrical leads. Plastic terminal covers/caps shall not be permitted.
d. A design for laminar flow to provide maximum efficiency in the transfer of UV to the water.
e. Level switches shall be located to position the wiper, and to prevent the wiper parking over the active arc tube. The switches shall be magnetic type, and shall include visual indication of the wiper position. The wiper mechanism shall be fail safe, and shall shut the system down in the event of failure, as described below.
f. The chamber shall contain a quartz sleeve, which is sealed at both ends by a UV shrouded O ring. The quartz must be annealed for durability and against breakage. Systems that contain a quartz thimble shall not be permitted. The thimble is inherently buoyant and poses a safety risk to operators during annual maintenance.
g. The wetter surfaces shall be chemically passivated and all welds ground to eliminate any potential corrosion mechanisms. Crevices (as found behind a quartz thimble) shall not be permitted under any circumstance.

2. Automatic Wiper System:
   a. For periodic cleaning of the quartz sleeves and the UV monitor probe, the chamber shall be fitted with an automatic cleaning mechanism. It shall consist of a single SS yoke with Teflon bosses and replaceable molded viton wiper rings which travel the full length of the quartz sleeve twice per cleaning cycle. The frequency of the wiper cycle shall be adjustable from 15 to 720 minutes and set for job conditions. The mechanism shall be driven by a two-pole bi-directional electric motor and acme lead screw. Reed type limit switches shall control the length of travel. The wiper mechanism wiper rings in the "parked" position shall not be over the lamp, blocking the transfer of UV light, or creating a "hot" spot on the arc tube.
3. UV Lamp:
   a. The UV lamp shall be a high intensity, medium-pressure UV arc tube modified to emit a continuous UV spectrum from 220nm to 400nm into the water. Full output must be available from 0 to 200 degrees. The lamp shall be UL approved with one electrical lead at each end. Each lamp shall be individually numbered and the manufacturing process shall permit full audit and traceability of assembly. In addition to an individual serial number, the part number shall be displayed on the lamp.
4. UV System Control:
   a. The system control cabinet shall be epoxy coated steel, NEMA 4X, fan cooled with louvers and replaceable filters. The control system shall be de-energized when the cabinet door(s) are open. All wiring shall be harnessed in DIN channels. The power supply to the UV arc tubes shall be from a constant

wattage transformer. The entire system shall be UL listed and there shall be a decal clearing showing this listing displayed in the cabinet.

b. The system shall include a microprocessor-controlled power switching function with 4 power levels designed to automatically adjust UV dosing to accommodate varying water quality levels & UV lamp degradation.

c. The control cabinet shall display via a back lit liquid-plasma display the following information:
   1) Power on
   2) UV intensity (% and mW/cm2)
   3) UV dose (mJ/cm2)
   4) Flow rate in GPM
   5) Arc tube ready indicator
   6) Any alarm condition
   7) Wiper status and alarm
   8) Consumable spare part list with part numbers
   9) Local/remote operation switch, door mounted
   10) Data logging of UV dose, lamp hours, lamp intensity for regulatory audit.

d. Control panel: The control panel shall contain an Earth Leakage detector, which shall provide fail-safe protection for bathers and those working on the equipment within the pool environment. This requirement is mandatory, as the voltages used within UV systems can pose risk of death. The control panel shall be UL LISTED, and in addition shall conform to EN 61000. The panel and all UV components shall be manufactured to ISO 9001-2000.

PART 3 EXECUTION

3.1 GENERAL

A. Provide all installation necessary for a complete and operational spray park water chemistry control system. All installation shall be in accordance with manufacturer's instructions and local codes and ordinances.

B. Provide all electrical installation required to include connection of the chemistry control panel, pumps, valves, sensors, and the like. Electrical installation shall be per the equipment manufacturer's instructions. Electrical installation shall include wire, conduit, outlets, breakers, and any other devices for a complete and functional system.
   1. Contractor shall be responsible for providing design & engineering for all field-installed wiring systems, including but not limited to interlocks, control wiring, etc.

C. Firmly support all piping. Run piping so that it will be out of the traveled way, and will not constitute a hazard for maintenance or tripping.

D. Provide grounding for all equipment as required by equipment manufacturer. Refer to electrical specifications for grounding materials & methods.

E. Install all piping and tubing per the manufacturer's instructions.

F. All chemical feeders, chemical feed pumps, and chemical system solenoid valves shall be interlocked with the spray park water circulation system pumps and chemistry controller(s). Chemical feed equipment shall be deactivated when no flow is present in spray park water circulation system.

3.2 CONTROLS

A. Provide all manufacturer-specific components and accessories needed to accomplish the following system tasks:
   1. ORP monitoring
   2. pH monitoring
   3. ORP control (chlorine control)
   4. pH control
   5. Level Monitoring
   6. Makeup water control

3.3 ULTRAVIOLET WATER TREATMENT SYSTEMS

A. The UV system shall be installed under the supervision of a factory-certified representative. All installation shall be in accordance with manufacturer's instructions.

B. The UV system shall be started up by a factory-certified agency.

C. Provide installation for stand-alone operation. This includes automatic activation on spray park circulation pump activation, automatic wiper operation, local display of alarms, and any other controls and interlocks recommended by the manufacturer.

3.4 STARTUP

A. On-site start-up shall be performed by a factory-trained and authorized representative.

3.5 TRAINING

A. On-site training shall be performed by a factory-trained and authorized representative.

END OF SECTION

SECTION 13 15 23

SPRAY PARK WATER FEATURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water features for spray parks.

1.2 REFERENCE STANDARDS

A. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

B. ASTM F2373 - Standard Consumer Safety Performance Specification for Public Use Play Equipment for Children 6 Months through 23 Months

C. US DOJ ADA - Americans with Disabilities Act Standards for Accessible Design

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Manufacturer's product data.

C. Record documents.

D. Maintenance spare parts.

1.4 QUALITY ASSURANCE

A. Suppliers: Equipment & accessories shall be designed, fabricated, installed and tested by a manufacturer with a minimum of 5 years' experience and at least 10 projects of similar size and scope.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Use all means necessary to protect the materials of this section before, during and after installation. The installer shall carefully inspect all material before beginning work and report any damage to the Owner's representatives before using said material. Any contractor-provided materials found to be unacceptable will be replaced at no cost to the Owner.

C. All protective wrappings are to be left intact through installation and then removed upon completion.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide all necessary components for a complete system. Some of these components may be shown only on the Plans, but shall be provided under this Specification.

B. Provide flange connections or unions for all equipment connections.

C. Provide electrical grounding & bonding for all spray features. Grounding & bonding materials & methods shall be per electrical specifications for grounding & bonding. Contractor shall provide design & layout for grounding & bonding systems.

D. Electrical connections for all water features shall be provided in conduit and shall be completely watertight.

E. Electrical wiring inside post- or feature-mounted or bollard-type water features shall be run in conduit and shall be completely watertight.

F. Finishes for all water features shall be coordinated with Landscape Architect.

G. Spray Features:
   1. General:
      a. Spray features shall be as shown on drawing schedules.
      b. Provide spray feature manufacturer's recommended footings & mounting components for all features. Aquatic play features will be supplied with all necessary anchoring hardware and installation templates to accommodate site work.
   2. Accessories: All hardware, fittings, & accessories shall be provided as necessary to complete installation. Anchors & anchor fasteners shall be stainless steel. Lag bolts shall be stainless steel with flat type vandal-proof heads. Tamper proof hardware shall be stainless steel. Provide (2) tools to owner for each type & size for all tamper proof hardware.

PART 3 EXECUTION

3.1 GENERAL

A. Install all components in accordance with the manufacturer's instructions and the applicable codes.

B. All protective wrappings are to be left intact through installation and then removed upon completion.

C. All assemblies shall be installed in accurate location (per architectural & pool mechanical design documents), in required location to surrounding finish grade, on footings.

D. Provide spray feature manufacturer's winterization plates for all removable water features and ground spray features with removable/replaceable nozzles.

E. Removable Water Features:
   1. Water features with detach-and-exchange type flange mounts shall be installed so that top surface of flange on water feature and top of winterization cover plate shall be level with adjacent surface (spray pad).
      a. Where features are located in sloped concrete, the feature base shall be set horizontal, with concrete built up to feature base edge.
   2. Features with non-flush mounting systems shall include rounded bumper enclosures or similar protection.

F. Where features are located in sloped concrete, the feature base or body shall be set horizontal, with concrete built up to feature base edge.

G. Contractor shall set final feature elevations (top elevation for ground sprays, base/mount elevation for removable features) based on slope of concrete pad where feature is located. Feature elevation shall be as close to concrete surface as possible.

3.2 SPARE PARTS

A. Provide 2 spare spray nozzles of each type and size utilized on project.

B. Provide 2 spare winterization plates of each type and size utilized on project.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Common work results for Division 22 (plumbing).

1.2 SUMMARY

A. Section includes general requirements that apply to the entirety of Division 22 - Plumbing, both interior and exterior to the building, as indicated on the plans and specified herein.

B. All specification sections with Division 22 - Plumbing are complementary. All specification sections within Division 22 shall be considered to reference each other.

C. Provide all plumbing work as indicated in the drawings and specified herein.

1.3 REFERENCE STANDARDS

A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.

B. AISC Steel Handbook.

C. ASHRAE Applications Manual.

D. ASME 31.9 - Building Services Piping.

E. ASTM D1557 - Method of Test for Moisture Density Relations of Soils.

F. IBC - International Building Code.

G. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.

H. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

I. NFPA 70 - National Electrical Code.

J. RCW 18.106 - Plumbers.

K. SMACNA Duct Construction Standards, Metal and Flexible.

L. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

M. UPC - Uniform Plumbing Code.

N. WAC 51-11C - Washington State Energy Code, Commercial Provisions.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide product data for all components and equipment provided under this Division.
   1. Product sheets with more than one item or option shown shall have the product(s) and options to be used on the project clearly identified.
   2. Any equipment or materials installed or furnished without prior approval of the Owner's Representative shall be rejected and such materials will be required to be removed and replaced with approved materials at the expense of the Contractor.

C. Shop Drawings:
   1. Shop drawings shall be submitted for review and approval prior to beginning work.
   2. Shop drawings shall indicate routing of piping and location of all equipment to be provided, and shall reflect coordination with other disciplines and existing conditions.
   3. Shop drawings shall be provided for the following systems:
      a. Plumbing
   4. Provide coordination shop drawings showing all project scope(s) including architectural, structural, mechanical, electrical, and specialty contractors.

D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports, inspection reports, and commissioning reports.

F. Project Record Documents:
   1. Record actual routing of installed piping, including elevation (or depth for buried piping).
   2. Record actual equipment and components installed, as well as locations.
   3. RFI's, change orders, and the like shall be noted on the Record Documents where these affect the layout or other aspect of project shown on the documents. References to these shall include the RFI/change order number as well as written description(s), sketch(es), etc., indicating the change or clarification.
   4. Record actual location of installed valves and control components.
      a. Include riser diagram(s) and schedule of valve tags and locations.
   5. Final record documents:
      a. Upon completion of the project the as-built information shall be neatly transferred to a clean set Plans. This set of Plans shall be submitted for final approval and acceptance.

G. Operation and Maintenance (O&M) Data:
    1. Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.
    2. Include manufacturer's warranty information, including any extended warranties, or certifications of warranties required for specific products, systems, or installations.
    3. Include certification of inspection(s) from the Authority Having Jurisdiction for the applicable work scope(s).
    4. Include certification of training.
    5. Include certification of Contractor's one-year warranty of materials and workmanship, including effective date(s) of warranty period.
    6. Include SDS sheets for all chemicals, adhesives, etc., utilized in the construction process as well as those utilized by or in the constructed system(s).

H. Seismic support calculations and any related required certification(s).

I. Warranty Information:
    1. Certificate of installing contractor's one-year warranty.
        a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
    2. Certificate of product manufacturer's warranty.
        a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
    3. Certificate of extended warranty.
        a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).

1.5 QUALITY ASSURANCE

A. Manufacturer: A company specializing in manufacturing products specified in Division 22 with a minimum of three years documented experience.

B. Contractor: The contractor shall be a Washington State licensed plumber.

C. Backflow Testing: All testing of backflow prevention equipment shall be done by a Washington State Certified Backflow Assembly Tester (BAT) certified to work in buildings.

D. Electrical Work:
    1. Contractor: Electrical work required under this Division shall be performed by a Washington State Licensed Electrician.
    2. Electrical work required under this Division shall require an electrical permit.

a. Electrical permit shall be procured by the Division 22 contractor or their electrical subcontractor.

3. Electrical Equipment
   a. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection(s), such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., shall be provided with an approved label from either Underwriters Laboratories (UL), the American Gas Association (AGA) or the Canadian Standards Association (CSA).
   b. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector.
   c. It shall be the responsibility of the Contractor to meet the Agency Approval requirements of this section. Any allowance for agency costs to provide appropriate label for a piece of equipment must be included in this Bid and Contract. Failure by the Contractor or supplier to obtain labels associated with agency approval prior to bid shall be sufficient cause for the Contractor to obtain all such labels and approvals at no additional cost to Owner.

E. Performance Certification: All equipment performance (water flow, heating capacity, etc.) shall be certified by a recognized national agency such as the Air Conditioning and Refrigeration Institute (ARI), Air Movement and Control Association (AMCA) and the American Society of Mechanical Engineers (ASME).

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.

C. Protect products from weather and moisture. Provide coverings of plastic or canvas. Cover openings into pipe and duct. Isolate components from contact with the soil. Provide a means of heating for those components that may become damaged by high or low temperatures.

D. For extended outdoor storage, remove motors and other electrical equipment from enclosures not designed for outdoor use and store separately.

1.7 DEFINITIONS

A. The term "approved equal" means final approval by the Architect of a material or piece of equipment substituted for that which is shown in the Specifications or Plans.

B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

C. The term "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refer to those subcontractors working under the direction of the General Contractor (GC).

1.8 MISCELLANEOUS REQUIREMENTS

A. Intent of Drawings
   1. The drawings are intended to depict the general scope of arrangement. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in piping. Provide additional fittings, offsets and extensions in piping systems and related items to provide full systems functionality and to assure access for equipment maintenance and as detailed elsewhere in the contract. Relocate or shift piping where conflict exists with other plumbing or mechanical systems, structural elements, architectural elements, or electrical systems, or other project work scope(s). Report conflicts before proceeding with work. Provide reasonable planning and layout in advance of installation in order to avoid conflicts and delays. The Contractor will be directed to adjust systems due to conflicts that could have been reasonably foreseen at the Contractor's own expense.
   2. Examine the Architectural, Structural, Electrical, and other project drawings before work is started. Consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to provide reasonable coordination shall result in the Contractor, at his own expense, moving his work to provide the necessary space for the other Contractors.

B. Permits and Fees: Obtain and pay for all permits and construction fees. Furnish Final Certificate to Owner showing compliance with code requirements.

C. Scheduling: Comply with requirements of Division 1.

D. As-Specified Equipment: These specifications and drawings; generally list only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition the listed product is the basis of the design regarding physical size, capacity, electrical power requirements and performance. The product so identified is designated "as specified."

E. Prior Approvals:
   1. Specifications have been written around equipment and materials selected for this project based on quality, size, capacity, and performance required to meet building design criteria. All equipment and materials used in this project that have been specified around a specific product or products shall have prior approval for product substitutions.
   2. Request for Approval must be submitted in accordance with Division 1 requirements.

3. Supplier and/or Contractor shall be responsible to ensure that substituted material or equipment is of same size, quality, capacity, weight and electrical characteristics as that specified or shown on the drawings. Any changes and cost increases required during construction due to substituted equipment; shall be paid by the Contractor/Supplier. Prior approval to bid does not mean final approval of material or equipment. Final approval will be given after final submitted data has been presented, complete with full information regarding weights, capacities, size, electrical requirements and quality.

F. Contractor's Cost Breakdown: Submit a cost breakdown (schedule of values) of the major portions of the work. Provide this submittal along with the equipment submittals. Organize the costs generally by specification section. For example, if one Section (such as copper piping) applies to both plumbing and hydronics, apportion the appropriate amount to each area of work.

1.9 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for general demonstration and training requirements.

1.10 REQUESTS FOR INFORMATION

A. Refer to Division 1 for Request for Information (RFI) requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. See technical specifications for detailed product specifications.

2.2 DAMAGED OR REJECTED MATERIALS

A. Damaged or rejected materials shall be removed from the site immediately upon discovery.

2.3 FIRE INTEGRITY

A. All mechanical system penetrations of fire rated assemblies shall be protected in accordance with the building code in force in the Authority Having Jurisdiction for this project. This includes piping, supports, conduit, and any other system and appurtenance provided by Division 22. In addition, all through-penetration sealing methodologies shall be listed in the Underwriter's Laboratories (UL) Fire Resistance Directory, issue current at time of bid.

2.4 MOTORS

A. Motors shall comply with the current edition of the Washington State Energy Code. Service factor for poly-phase motors shall be 1.15. Service factor for single phase motors shall be 1.35.

PART 3 EXECUTION

3.1 CODE COMPLIANCE

A. The Contractor shall comply with all applicable codes and requirements including but not limited to:
   1. Washington State Department of Health requirements.
   2. International Building Code, including local amendments.
   3. International Fuel Gas Code, including local amendments.
   4. International Mechanical Code, including local amendments.
   5. International Fire Code, including local amendments.
   6. Uniform Plumbing Code, including local amendments.
   7. National Electrical Code (NFPA 70), including local amendments.
   8. Washington State Energy Code.
   9. Requirements of the local Authority Having Jurisdiction (AHJ).
      a. Authority Having Jurisdiction: City of Seattle.

3.2 LAYING OUT WORK

A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work required under the Contract. Exercise proper precaution to verify figures shown on drawings before laying out work and be responsible for any error resulting from failure to exercise such precaution. Coordinate the utility installation with the final site grading and elevations. Locate existing utility lines that will be affected by the building location before any footing work begins. Report conflicts with the Plans before proceeding with the work. Failure to follow reasonable precautions with regards to this instruction will require Contractor to alter the work at the Contractor's expense.

3.3 ELECTRICAL WORK

A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to the NEC (NFPA 70) and all applicable codes.

B. All electrical work performed under this Section of the Specifications shall require a permit. Contractor shall obtain & pay for all required permits & fees.

C. All electrical work performed under this Section of the Specifications shall be performed by a electrician licensed in the jurisdiction where the work is performed.

3.4 WORKMANSHIP

A. Furnish and install all equipment in a neat and finished appearance. If any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall remove the equipment, reinstall and patch and paint surrounding surfaces without any increase in cost.

3.5 EXCAVATION - GENERAL

A. Provide all necessary excavation and shoring required for the proper installation plumbing systems.

B. Slope sides of excavation to comply with local codes and ordinances having jurisdiction.

C. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

D. Sewer trenches shall be excavated to the grade with the bottom rounded to the outside of sewer pipes.

E. Bell holes shall be hand excavated to ensure the pipes resting for their entire length upon the bottom of the trench.

F. In case of sewer lines in rock excavation, the excavation shall be made at least 4 inches deeper than required and backfilled with sand to outside invert grades to provide cushion.

G. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

H. Secure approval to excavate for all trenches near or under footings and for backfilling of such trenches.

I. No underground lines shall be covered until the installation has been approved by both Owner's technical representatives and the Local AHJ.

3.6 EXCAVATION DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collection or run off areas. Do not use trench excavations as temporary drainage ditches.

3.7 EXCESS EXCAVATION MATERIAL

A. Legally dispose of dirt and debris from excavation at an off-site location.

3.8 PIPE BEDDING

A. Provide sand or pipe zone bedding mix for pipe bedding.
   1. Native soil shall not be used as pipe bedding material.
   2. Remove all rocks or other objects from bedding material that may damage piping.

B. Pipe bedding material shall be provided all around the piping, to the following minimum amounts:
   1. Below bottom of pipe: 4 inches
   2. Above top of pipe: 4 inches
   3. From each side of pipe: 4 inches
   4. Pipe bedding shall be compacted to ensure even support for all buried piping systems.

3.9 BACKFILL

A. All backfill shall be thoroughly mechanically compacted.

B. Excess excavation shall be backfilled with gravel or sand and mechanically compacted to give full support to the pipe.

C. No cinders shall be used for backfilling where steel, iron or copper pipe is used.

D. All soil foundation areas which will in any manner support any load bearing building components shall be compacted, by the use of mechanical tampers, to at least 95% of the maximum density of the soil foundations as determined by the compaction control test in accordance with the "Method of Test for Moisture Density Relations of Soils, ASTM D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described "Compaction Control Test." Place fill in 8 inch loose layers, each layer compacted.

3.10 PIPE INSTALLATION

A. Lay pipe in straight lines with uniform slope, leaving no pockets. Care shall be taken to keep all foreign materials out of the pipes during installation. Where ground water is present, provide suction pumps to keep trenches free of water, and cap end of piping exposed to ground water when work is interrupted.

B. All underground piping used for the distribution of domestic water or waste drainage systems, which are located outside the building perimeter, shall be buried a minimum of 24 inches from finish grade to top of pipe.

C. All piping and ductwork run above the floor shall not be located over electrical panels or switchboards except where located above the structural ceiling. This shall include, but not be limited to, sanitary waste and vent, storm drain and rainleaders, domestic water, and condensate drain piping.
   1. Where routing above electrical distribution equipment cannot be avoided, stainless steel drip pans shall be provided. Drain piping from drip pans shall be routed to nearest indirect drain location (such as standpipes, floor/funnel drains, floor sinks, air gap fittings, etc.).

D. Isolation valves shall be provided on inlets and outlets of all major pieces of equipment to facilitate serving and removal of such equipment without the necessity of draining the associated system.

E. Provide detectable metallic underground tape for all buried piping. Install between 6”-12” above piping. Color scheme and text shall be appropriate to the associated system, and can be the manufacturer’s standard color and description.

3.11 OPENINGS IN PIPES

A. Keep closed during the work.

3.12 WALL AND FLOOR PLATES AND ESCUTCHEONS

A. Where pipes pass through finished walls, floors or ceilings, provide chromium plates, with suitable set screws or other approved holding devices. Where extended sleeves are necessary, the plates shall be of sufficient depth to cover the sleeves.

3.13 INSERTS

A. Inserts in concrete for the suspension of piping and equipment; shall be provided by this Contractor unless otherwise noted on the Plans. Provide as necessary for support of systems installed.

B. Inserts in "poured in place" concrete shall be Grinnell, Kinsdorf, Elcen, or approved equal.

3.14 CUTTING AND PATCHING

A. General:
   1. Provide all saw cutting, core drilling, and other work (including patching) necessary for installation of plumbing systems.
   2. Prior to cutting, saw cutting, or core drilling any concrete, Contractor shall locate any reinforcing steel (rebar) and the like located in the concrete where the cutting is to be performed. Obtain specific approval prior to cutting any concrete

reinforcement. Approval must be obtained for each specific instance of cutting reinforcement.

3. Unless directed otherwise by Structural Documents, maintain the following minimum clearances from any concrete reinforcement:
    a. Reinforcing steel: 2”

B. New Work: Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. The expense for cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be borne by this Contractor.

C. Existing Structure:
    1. All necessary cutting and patching of existing structures necessary for the installation of mechanical work shall be as part of this Contract. Unless cutting and patching locations are specifically shown on the drawings, obtain approval prior to proceeding.
    2. All surfaces must be patched upon completion of work. Final finish of all patched surfaces (walls, ceilings, floors etc.) shall be done patched to match the adjacent surface.
    3. Contractor shall locate all steel in existing structure using x-ray or similar scanning equipment prior to cutting into existing structure.

3.15 MAINTENANCE AND OPERATION ACCESS

A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
    1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
    2. Access door locations shall be approved by the Architect prior to installation.

B. Access Panels
    1. Provide access panels for all concealed equipment, valves, and the like that requires adjustment or service access, as well as for all wall cleanouts. Panel locations shall be carefully selected on the job so as not to be located behind cabinets, lights, etc.
        a. Coordinate with the work of other Contractors before installing panels.
        b. Panels shall be prime coated and painted to match surrounding surface.
        c. In finished areas, including ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.
        d. Panels shall be size appropriate for the service intended.

e. Provide UL labeled fire rated access doors for one or two-hour rated walls and ceilings.
f. Install before surrounding surfaces have been painted.
g. Access panel doors shall have cylinder lock latch, all keyed alike.
h. Provide access doors in ceiling or wall adjacent to all fire damper locations.
i. Verify with Architect the location and finish of all access panels.
j. Panels shall be J.R. Smith or equal.

3.16 ZONE ISOLATION

A. At a minimum, provide isolation valves at plumbing connections to all spaces with plumbing in the building including the following:
1. Each restroom.
2. Each utility space.
3. Kitchen areas.

B. Plumbing systems to be provided with isolation valves:
1. Domestic CW systems.
2. Domestic HW systems.
3. Domestic HW recirculation systems.

3.17 SEISMIC SUPPORT

A. Piping: Support piping per the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.

3.18 FIRE INTEGRITY

A. Maintain the fire rating of all assemblies (wall, ceiling, floor, etc.) penetrated by mechanical systems. Provide approved firestopping materials as previously specified, and install in accordance with the conditions of the material UL listing.

3.19 PRESSURE TESTS AND IN-SERVICE TEST

A. All work under this Contract shall be thoroughly and systematically tested, both during construction and after completion. Pipe testing shall be either as specified in the appropriate specification section, or as specified in the applicable plumbing or mechanical code. Tests shall be maintained until approved.

B. Notifications shall be sent to the following parties 48 hours in advance of all tests:
1. Architect.
2. Owner.
3. Authority Having Jurisdiction over the specific work to be inspected.
a. Notifications to AHJ shall be provided in accordance with requirements of each specific AHJ, including amount of advance notice allowed.

C. No systems, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing without first notifying all of the above-listed parties for inspection. Failure to provide such notification of concealed systems shall be cause to require this Contractor to uncover and re-cover such systems at no additional cost.

D. A log of all tests shall be kept. The log shall note date, time of day test started, system or portion of system tested, length of test and test results.

E. The Contractor shall test the completed installation as in regular service. The systems provided under this Contract shall be operated in normal service for a period of at least a week prior to requesting substantial completion inspection, and any resulting defects repaired.

F. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from the date of final acceptance, and shall repair or replace any part which may show signs of failure in that time if such failure is due to imperfections in material or to improper workmanship.

3.20 STARTUP, BALANCING AND COMMISSIONING

A. Equipment Startup
   1. Equipment startup shall be performed by factory-trained and certified technicians.
   2. Provide a statement of the startup technician's qualifications if requested by the Architect or elsewhere specified.

B. Testing and Balancing
   1. The contractor shall adjust installed systems to meet the performance indicated on the drawings and for proper operation of all systems.

C. Commissioning
   1. Provide system adjustment to demonstrate compliance with design documents. Provide documentation to meet basic commissioning requirements of Washington State Energy Code section C408.

3.21 CLEANING UP

A. Comply with requirements of Division 1.

B. Pipes shall be maintained as clean as possible during construction, and shall be blown clean before the building field painting operations are started. Piping shall shall be thoroughly cleaned before systems are operational. Strainers shall be cleaned prior to turning the system(s) over to the owner.

C. All equipment and material installed by this Contractor shall be properly protected from damage during the course of construction.

D. Enamelware or china fixtures around which plaster is installed or paint is applied shall be covered with heavy wrapping paper thoroughly secured.

E. Fixtures and equipment shall be thoroughly cleaned before final inspection. Remove all labels from plumbing fixtures.

F. In utility rooms and other spaces where piping such as domestic water, condensate drains, stormwater, rainleader, sanitary sewer, or vent have been installed at floor level and interfere with foot traffic, the Mechanical Contractor shall provide covers to protect these pipes. Wood or other such material is acceptable. Where duct plenums or duct runs interfere with normal traffic pattern of maintenance personnel, the Mechanical Contractor shall provide a wooden bridge over the ducts to prevent damage. Provide handrails for bridge(s) where required by code.

3.22 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.

B. Any damage to the building, systems, or property, caused by the Contractor shall result in the Contractor repairing or replacing the damaged item(s) at no additional cost to the Owner. This provision shall include any preventable damage caused by lack of due diligence in planning and investigation, and shall not be applied to field conditions which could not reasonably be ascertained prior to the activity causing damage.

C. In attic or other spaces where piping has been installed at floor level and interferes with foot traffic, the Contractor shall provide permanent covers to protect these items. Wood or other such material is acceptable. Provide handrails where required by code.

3.23 CAULKING

A. Caulk all openings and flash around all piping, equipment, and ducts passing through roof, floor, and walls.

B. All caulking shall be waterproof, low-VOC, and zero mold growth type.

C. Refer to paragraph "Fire Integrity" for all rated wall, ceiling, floor, and other penetrations.

3.24 FINAL INSPECTION

A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall provide notification. It shall be understood that the work shall be essentially complete, and the open items list provided at that time. The warranty period will not start until the punchlist and back-check are complete.

Additional inspections required because of lack of diligence by the Contractor will be conducted on a schedule convenient to the inspectors.

3.25 INSTRUCTION PERIODS

A. Refer to Division 1 for additional demonstration and training requirements.

B. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner’s staff.

C. General Description Of Instruction Period: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings; followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, and equipment cleaning procedures, temperature control settings and available adjustments.

D. Scheduling Of Instruction Period: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given at least two weeks prior to the instruction period, and agreement finalized as to the date at which the instruction period is to be performed. Notify two weeks prior to date when ready to conduct instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

3.26 ON SITE OBSERVATIONS AND SAFETY MEASURES

A. The Contractor is solely responsible to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The duty of any other individual or organization to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. The contractor shall be responsible for providing all safety measures and shall consult with the State and/or Federal Safety Agency or Inspector for interpretation whenever in doubt as to compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damages or injury to any persons or property wherever located resulting from any action or operation under this Contract or in connection with the work.

3.27 CONTINUITY OF BUILDING AND UTILITY AND SHUTDOWNS

A. General: Continuity of utilities services in the building shall be maintained at all times as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services; shall be accomplished in accordance with the following requirements.

B. Shutdowns:

1. While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings.
2. Shutdowns longer than 2 hours shall be coordinated with and approved by the Owner at least 1 week in advance.
3. Shutdowns less than 2 hours shall be coordinated with and approved by the Owner at least 48 hours in advance.

C. Costs: The Contractor shall include in their bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes or failure to complete utilities connections within authorized shutdown periods.

D. Liability: Failure to coordinate with the serving utility or to sufficiently pursue the work in time to return utilities to service shall not constitute a basis for avoiding any contractual penalties.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Indicating thermometers

B. Pressure gauges

C. Thermowells

D. Water meters

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)
   1. ASME B40.100 - Pressure Gauges and Gauge Attachments
   2. ASME B40.200 - Thermometers, Direct Reading and Remote Reading

B. American National Standards Institute (ANSI)
   1. ANSI/IEC 60529 - Degrees of Protection Provided by Enclosures

C. American Society for Testing and Materials (ASTM International)
   1. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers
   2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers

D. American Water Works Association (AWWA)
   1. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Required Submittals:
   1. Product data.
   2. Test and Inspection Reports:
      a. Completed manufacturer's startup checklist and report.
      b. Commissioning report.
   3. Project record documents.
   4. Operation and maintenance data.
   5. Warranty information:
      a. Manufacturer's warranty.
      b. Manufacturer's extended warranty.
   6. Training certificates.

C. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

C. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal procedures.

B. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 INDICATING THERMOMETERS

A. Mercury type thermometers are not acceptable.

B. Dial type: ANSI B40.200, Provide thermowell sized for each thermometer. Thermometer shall be 5" dial size with stainless steel case & stem. Case shall be hermetically sealed. Accuracy shall be +/- 1% or better. Coil shall be bimetallic type (silicone dampened on ranges up to 300°F, above 300°F not dampened). Window shall be double-strength glass. Thermometer shall be adjustable for viewing angle.

C. Standard type: ANSI B40.200, Provide thermowell sized for each thermometer. Thermometer shall have a nominal scale length of 5". Construction shall be stainless-steel case with molded glass cover, stainless-steel stem and bulb. Stem shall be straight, length as required to fit well.

2.2 PRESSURE GAUGES

A. Gauges, Pressure and Compound
   1. Stainless steel liquid filled gauges. 4" diameter. IP65 protection as rated under ANSI/IEC 60529 standards.
   2. Provide normal working range of 50 % full scale.
   3. Ambient Temperature Range: -40 degrees F to 140 degrees F.
   4. 316 stainless steel element.
   5. Laminated safety glass window.

6. White aluminum dial with black lettering.
7. Pressure Connection: 1/2”.
8. Case, Bezel Ring And Movement: 304 stainless steel.
9. Provide piston snubber and isolation cock valve. Snubber shall be brass body with minimum pressure of 5000 PSI. Snubber shall include a piston that moves within a chamber. The action of the piston in the chamber provides damping for the gauge and protects the gauge from debris in the working fluid.

2.3 THERMOWELLS

A. Pressure/temperature thermowells (“Pete’s Plug” or equal) shall be installed on inlet and discharge of all pumps and coils unless other different instrumentation that performs the same function is shown on the drawings. Provide a gauge kit that includes a pressure gauge and thermometer compatible with the thermowells.

2.4 WATER METERS

A. Single-Jet Type with Digital Encoder/Register (WM-1, WM-2)
   1. Meter shall be single element measuring type, with 1/8 gpm accuracy and no upstream or downstream straight pipe length requirements for installation. Meter shall meet NSF-61 and AWWA C712-15 standards.
   2. Construction
      a. Meter body: ASTM C875 low-lead bronze.
      b. Impeller: Polypropylene
      c. Impeller Bearings: Tungsten carbide
      d. Impeller Shaft: AISI 303 with tungsten carbide tip
   3. Encoder/Register
      a. Provide digital encoder/register for each water meter. Encoder/register shall have integral cellular modem with external external antenna. External antenna shall be 12' long. Encoder/register shall be battery powered. Encoder/register shall be remote-mount type, with interconnecting cable between meter body and encoder unit.

B. Single-Jet Type with Digital Encoder/Register (WM-2)
   1. Meter shall be single element measuring type, with 1/4 gpm accuracy and no upstream or downstream straight pipe length requirements for installation. Meter shall meet NSF-61 and AWWA C712-15 standards.
   2. Construction
      a. Meter body: ASTM C875 low-lead bronze.
      b. Impeller: Polypropylene
      c. Impeller Bearings: Tungsten carbide
      d. Impeller Shaft: AISI 303 with tungsten carbide tip
   3. Encoder/Register

a. Provide digital encoder/register for each water meter. Encoder/register shall have integral cellular modem with external external antenna. External antenna shall be 12' long. Encoder/register shall be battery powered. Encoder/register shall be remote-mount type, with interconnecting cable between meter body and encoder unit.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

C. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage. Not required for fractional horsepower pumps.

D. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install thermometers in air duct systems on flanges.

G. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 09 23 - Direct Digital Controls for HVAC. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

H. Coil and conceal excess capillary on remote element instruments.

I. Provide instruments with scale ranges selected according to service with largest appropriate scale.

J. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

K. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

L. Locate test plugs adjacent thermometers and thermometer sockets

3.2 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Globe, angle and swing check valves

B. Non-slam or silent check valves

C. Butterfly valves

D. Ball valves

E. Valves for PVC systems

1.2 REFERENCE STANDARDS

A. Federal Specification (Fed. Spec.):
   1. WW-V-1967 Valves, Butterfly (Threaded Ends and Solder Ends), Brass or Bronze W/AMD-1

B. American Society for Testing and Materials (ASTM):
   1. A47 Ferritic Malleable Iron Castings
   2. A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   3. A536 Ductile Iron Castings
   4. B62 Composition Bronze or Ounce Metal Castings

C. American Society of Mechanical Engineers (ASME):
   1. B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric Inch Standard.

D. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
   1. SP-67 Butterfly Valve of the Single Flange Type (Lug Wafer)
   2. SP-80 Bronze Gate, Globe, Angle and Check Valves
   3. SP-85 Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
   4. SP-110 Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Valve Tag List: Indicate valve numbers on the flow diagram. Submit annotated flow diagram.

D. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

1.4 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

B. Maintain one copy of submittal document on site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install valves underground when bedding is wet or frozen.

1.7 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal procedures.

B. Refer to Division 1 for demonstration and training requirements.

C. Project Record Documents: Record actual locations of valves.

D. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

PART 2 PRODUCTS

2.1 GENERAL

A. Asbestos packing is not acceptable.

B. All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

C. Provide chain operators for valves 4” and larger when the centerline is located 8’ or more above the floor or operating platform.

2.2 GLOBE, ANGLE AND SWING CHECK VALVES

A. 2” And Smaller: MSS SP-80, bronze, 150lb. Globe and angle valves shall be union bonnet with metal plug type disc.

B. 2½” And Larger: 125 PSIG, flanged, iron body, bronze trim, MSS SP-85 for globe valves and MSS SP-71 for check valves.

2.3 NON-SLAM OR SILENT CHECK VALVE

A. Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.

B. Body: Cast iron, ASTM A126, Class-B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.

C. Seat, Disc And Spring:
   1. 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.
   2. 2-3": Machined surface electroless nickel plated.
   3. 4" And Larger: Integrally welded-on nickel alloy.

D. 2-3": Rated for 365 PSIG working pressure.

E. 4" And Larger: Rated for 300 PSIG working pressure.

F. 14-24": Black enamel coated ductile iron body, ASTM A395, dual 304 stainless steel discs, EPDM seat, with 300 series stainless steel spring and shaft. Rated to 230 PSIG working pressure.

2.4 BUTTERFLY VALVES

A. Provide stem extension to allow 2” of pipe insulation without interfering with valve operation.

B. 2” And Smaller: Fed. Spec. WW-V-1967.

C. 2½” And Larger: MSS SP-67, flange lug type (for end of line service) or grooved end rated 175 PSIG working pressure at 200 degrees F.
   1. Body: Cast iron, ASTM A126, Class-B. Malleable iron, ASTM A47 electro plated, or ductile iron, ASTM A536, Grade 65-45-12 electro plated.
   2. Trim: Bronze, aluminum bronze, electroless-nickel coated, or 300 Series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer’s recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product. Stem shall be offset from the disc centerline to provide full 360-degree seating.
   3. Valves shall be rated for bubble-tight, dead-end, and bi-directional service.
   4. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.

a. Valves 6” And Smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
b. Valves 8” And Larger: Enclosed worm gear with hand wheel, and where required, chain wheel operator.

2.5 BALL VALVES

A. MSS SP-110. Provide stem extension to allow operation without interfering with pipe insulation.

2.6 VALVES FOR PVC SYSTEMS

A. Butterfly Valves: 8” and smaller, Asahi, Hayward, or approved, lever operated, V-notch, PVC body, PVC disc, Viton seat.

B. Ball Valves: 4” and smaller, Asahi, Hayward or approved, true union type with teflon seat and removable ABS handle, PVC body, socket ends.

C. Check Valves: Wafer-style swing check, PVC body and disk, EPDM O-rings, stainless steel springs.

D. Flanges shall be Schedule 80 PVC. Dimensions to conform to ASME B16.5.

PART 3 EXECUTION

3.1 GENERAL

A. Provide valves with stems extended to permit operation without damage to the insulation.

B. Valves shall be installed with stems horizontal or above horizontal except for ball or butterfly valves, which may be installed with valve stems down.

C. Gate valves shall not be used for throttling service.

D. Provide Tags For All Valves. Tags shall be phenolic material.

E. All other practices for valves shall be the same as for the system in which they are to be installed and the valve manufacturer’s instructions.

END OF SECTION

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.

B. Strut systems for pipe or equipment support.

C. Beam clamps.

D. Pipe hangers.

E. Pipe supports, guides, shields, and saddles.

F. Nonpenetrating rooftop supports for low-slope roofs.

G. Anchors and fasteners.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MFMA-4 - Metal Framing Standards Publication; 2004.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

1.5 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Materials for Metal Fabricated Supports: Comply with Section 055000.
   1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
   2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
   1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   3. Corrosive Locations: Use 316 stainless steel, or approved equivalent.
      a. Corrosive locations shall include spray park mechanical rooms and chemical storage rooms.

2.2 PREFABRICATED TRAPEZE-FRAMED SYSTEMS

A. Prefabricated Trapeze-Framed Metal Strut Systems:
   1. MFMA-4 compliant, pre-fabricated, MSS SP-58 Type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
   2. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.

3. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

2.3 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
   1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
   2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

B. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.
   2. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Piping up to 1 inch: 1/4 inch diameter.
      c. Piping larger than 1 inch: 3/8 inch diameter.
      d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:
   1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.4 BEAM CLAMPS

A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

B. C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.

C. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).

D. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.

E. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.

F. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.5 PIPE HANGERS

A. Band Hangers, Adjustable:
   1. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

B. Swivel Ring Hangers, Adjustable:
   1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
   2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   3. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

C. Clevis Hangers, Adjustable:
   1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
   2. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.6 PIPE CLAMPS

A. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
   5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

B. Extension Split Pipe Clamp:
   1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
   2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   3. Provide hanger rod and nuts of the same type and material for a given pipe run.
   4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Strut Clamps:
   1. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

2.7 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. Stanchions:
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

C. U-Bolts:
   1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

D. Pipe Shields for Insulated Piping:
   1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
      d. Service Temperature: Minus 40 to 178 degrees F.
      e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

E. Pipe Supports:
   1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   2. Liquid Temperatures Up to 122 degrees F:
      a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
      b. Support From Below: MSS SP-58 types 35 through 38.

F. Pipe Supports, Thermal Insulated:
   1. General Requirements:
      a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
      b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
      c. Provide pipe supports for 1/2 to 30 inch iron pipes.
      d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
   2. PVC Jacket:
      a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
      b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
      c. Minimum Thickness: 60 mil, 0.06 inch.

2.8 ANCHORS AND FASTENERS

A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

B. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

C. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

D. Hollow Masonry: Use toggle bolts.

E. Hollow Stud Walls: Use toggle bolts.

F. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

G. Plastic and lead anchors are not permitted.

H. Powder-actuated fasteners are not permitted.

I. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

J. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   1. Channel Material: Use galvanized steel.
   2. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 22 05 33

HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

B. Cable outer jacket markings.

C. Connection kits.

D. Accessories.

E. Controls.

1.2 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2022.

B. ITS (DIR) - Directory of Listed Products; Current Edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.

C. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal requirements.

B. Product Data: Provide data for electric heat tracing.

C. Field Quality Control Submittals: Indicate test reports and inspection reports.

D. Project Record Documents: Record actual locations of electric heat tracing lines and thermostats.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

PART 2 PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).

B. Factory Rating and Testing: Comply with IEEE 515.1.

C. Heating Element:
1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
3. Capable of crossing over itself without overheating.

D. Insulated Jacket: Flame retardant polyolefin.

E. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

F. Maximum Power-On Operating Temperature: 150 degrees F.

G. Maximum Power-Off Exposure Temperature: 185 degrees F.

H. Electrical Characteristics:

2.2 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

2.3 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

2.4 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
   1. High temperature, glass filament tape for attachment of heating cable to metal piping.
   2. Aluminum self-adhesive tape for attachment of heating cable to plastic piping.
   3. Heat-conductive putty.
   4. Cable ties.
   5. Silicone end seals and splice kits.
   6. Installation clips.
   7. Warning labels for attachment to exterior of piping insulation.

2.5 CONTROLS

A. Pipe Mounted Thermostats:
   1. Remote bulb on capillary, resistance temperature device (RTD) or thermistor for direct sensing of pipe wall temperature.
   2. Control Enclosure: Corrosion resistant and waterproof.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.2 PREPARATION

A. Clean exposed surfaces prior to installation.

B. Prepare surfaces using approved methods as recommended by manufacturer.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with applicable local building codes and requirements of authorities having jurisdiction.

E. Grounding: Refer to Division 26.

F. Identification:
   1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.

G. Wiring: Refer to Division 26.

3.4 FIELD QUALITY CONTROL

A. Perform start-up by factory technician or factory representative as per Owner's requirements.

B. Field Testing and Inspections:
   1. Commission system in accordance with installation and operation manual.
   2. Inspect for sources of water entry and proper sealing.
   3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
   4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
   5. Test heating cable integrity with megohmmeter at the following intervals:
      a. Before installing the cable.
      b. Prior to initial start-up (commissioning).
   6. Measure voltage and current at each unit.
   7. Controls:
      a. Verify control parameters are set to the application requirements.
   8. Submit written test report showing values measured on each test for each cable.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate operation of controls.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Schedules:
   1. Submit plumbing component identification schedule listing equipment, piping, and valves.
   2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
   3. Valve Data Format: Include id-number, location, function, and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:
   1. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:
   1. Valves.

C. Pipe Markers: 3/4 inch diameter and higher.

D. Pipe Markers: Piping 1/2 inch diameter and larger.

2.2 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.3 TAGS

A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.

B. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

A. Comply with ASME A13.1.

B. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

C. Identification Scheme, ASME A13.1:
   1. Primary: External Pipe Diameter, Uninsulated or Insulated.
      a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
      b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
      c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
   2. Secondary: Color scheme per fluid service.
      a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.
   3. Tertiary: Other Details.
      a. Directional flow arrow.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

C. Apply ASME A13.1 Pipe Marking Rules:
   1. Place pipe marker adjacent to changes in direction.

2. Place pipe marker adjacent each valve port and flange end.
3. Place pipe marker at both sides of floor and wall penetrations.
4. Place pipe marker every 25 to 50 feet interval of straight run.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Glass fiber insulation.

C. Jacketing and accessories.

1.2 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER INSULATION

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

F. Indoor Vapor Barrier Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation, black color.

G. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

H. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

I. Insulating Cement: ASTM C449.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket:
   1. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass

mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION

SECTION 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Copper pipe and fittings.

B. PEX pipe and fittings.

C. PE pipe and fittings.

1.2 REFERENCE STANDARDS

A. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2012.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction Materials; 2018.

D. ASTM F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water- Pressure Piping Systems; 2015.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalog information. Indicate valve data and ratings.

C. Project Record Documents:
   1. Record actual installed locations of piping, valves, and equipment.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of undocumented utilities.

D. Operation and Maintenance Data: Provide product information and manufacturer's operation and maintenance information for all products used.

E. Purging and Disinfecting Reports

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

C. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.
   1. Installers for PEX piping systems shall be factory trained by the PEX piping and fitting manufacturer.

D. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

B. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located. Pothole and locate existing utilities prior to connection to existing utility. Locations shown on the plans have not been verified, and Contractor shall anticipate the actual location may differ from that shown. Service line serving the picnic area has not been field located.

C. Verify that water-service piping may be installed to comply with original design and referenced standards.

D. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
   1. Refer to Section 220500 - COMMON WORK RESULTS FOR WATER RECREATION SYSTEMS for notification requirements for service interruptions.
   2. Do not proceed with interruption of water-distribution service without Owner's written permission.
   3. Coordinate with utility provider for any interruption of existing water service.

1.7 COORDINATION

A. Coordinate connection to water service with utility provider.

PART 2 PRODUCTS

2.1 COPPER PIPE AND FITTINGS

A. Pipe: ASTM B88, Type-L.

B. Fittings and flanges:
   1. Cast Bronze Fittings: ASME B16.15.

2. Cast Copper Alloy Solder Joint Pressure Fittings: ASME B16.18.
3. Wrought Copper and Copper Alloy Solder Joint Pressure Fittings: ASME B16.22.
4. Cast Copper Alloy Solder Joint Drainage Fittings (DWV): ASME B16.23.
5. Cast Copper Alloy Fittings for Flared Copper Tubes: ASME B16.26.
6. Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings: ASME B16.29.

C. Alternate Fittings and Flanges:
   1. Rolled/grooved fittings.
      a. Couplings: 200 PSI minimum joint working pressure, cast ductile iron housing conforming to ASTM A536. Gaskets for heating water or chilled water service, elastomer in accordance with ASTM D2000. Gaskets for domestic water service, EPDM per ASTM D2000. All grooved couplings shall be designed with angle bolt pads to provide rigid joint.
      b. Flanges: 200 PSI minimum joint working pressure, cast ductile iron housing, suitable for bolting to ANSI Class-125 cast iron and 150 steel flanged components. Gasket material similar to coupling gasket material.
   2. Press fitting, Viega Rigid or Nibco Press System, conforming to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-ring for copper press fittings shall be EPDM.

D. Solder: ASTM B32, lead free.

2.2 CROSS-LINKED POLYETHYLENE (PEX) PIPING

A. PEX piping shall be PEX-a (Engel method) or PEX-b.

B. PEX piping and fittings shall be of the same manufacturer.

C. PEX-a piping systems shall use ASTM F1960 PEX expansion ring joint system. Fittings shall be engineered plastic, lead-free brass, lead-free bronze, or lead-free copper, of same manufacturer as piping and expansion ring system.

D. PEX-b piping systems shall use press fittings of same manufacturer as piping. Press fittings shall be constructed from lead-free bronze or Radel R polymer with 304 stainless steel sleeves. Sleeve fittings shall incorporate view holes and a tool locator ring to ensure proper press connections.

E. Pre-insulated PEX piping systems shall be allowed where both the piping and the pre-installed insulation systems meet or exceed the requirements of the drawings and specifications.

F. Pipe installed underground shall be factory insulated.

G. Fittings for transitions between PEX piping systems and other pipe materials and fitting systems shall be manufactured by the PEX piping and fitting manufacturer.

2.3 POLYETHYLENE (PE) PIPING

A. SDR 9 conforming to AWWA, C901. Service lines shall be copper-tube size with a minimum pressure rating of 200 psi and standard dimension ratio not to exceed 9. Pipe shall be either black with blue striping or blue in color. Stainless steel stiffening inserts are required at all connection points.

PART 3 EXECUTION

3.1 GENERAL PIPING INSTALLATION

A. General: Install per the Uniform Plumbing Code (UPC). Any UPC installation instructions located in Appendix "I" ("Installation Standards") for a specific piping material specified in this section applies to the work of this section.

B. Preparation:
   1. Clean off scale and dirt inside and outside before assembly. Cut pipes and tubes square and ream to remove all burrs.
   2. Cut pipe accurately to field measurements so work can be placed without springing or forcing.

C. Installation:
   1. Install so piping is free to expand, provide for all expansion with offsets or loops where necessary. Branch connections shall have three elbow spring pieces to allow for expansion.
   2. All changes in direction shall be made with fittings. All radius; shall be long radius.
   3. Arrange piping so as not to interfere with access or removal of other equipment or devices, block access to doors, windows, manholes or other access openings.
   4. Arrange piping to facilitate the removal of tube bundles, coils, etc. Provide unions ahead of screwed valves, traps or strainers on each side of each piece of equipment and wherever needed to dismantle piping.
   5. All piping shall be properly pitched and graded to drain moisture and/or vent air.
   6. Each low point shall have an accessible blind flange or screwed plug or cap.
   7. Route pipe to avoid liquid or air pockets throughout the work. Provide at high points of closed systems, collecting chambers and automatic air vents.
   8. Make reductions in pipe size using eccentric reducing fittings installed to provide drainage and venting.
   9. Nipples shall be of the same material as pipe. Close nipples shall not be used.
   10. Install pipe in neat and workmanlike manner, in accordance with best trade practice. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls unless otherwise shown. Where possible, group runs and rises.
   11. Install concealed pipes in walls with clearance around piping to prevent contact with structure.

12. Pipes passing through concrete or masonry construction shall be fitted with sleeves. The inside diameter of pipe sleeves shall be at least 1/2 inch larger than the outside diameter of the pipe or pipe covering.
    a. Refer to Section 131117 - SLEEVES AND SLEEVE SEALS FOR WATER RECREATION SYSTEMS for sleeve fabrication and installation instructions.
13. At all connections between ferrous and non-ferrous pipe:
    a. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation.
    b. Large Bore Pipe: Provide dielectric flanges.
14. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
15. Do not use unions for underground piping.

3.2 APPLICATIONS

A. Within Building Footprint:
    1. Above-grade, exposed areas, domestic water CW, HW, TW, and HWC: Copper or PEX (rigid only)
    2. Above grade, concealed areas, domestic water CW, HW, TW, and HWC: Copper or PEX
    3. Below grade, domestic water CW, HW, TW, and HWC: PEX

B. Outside Building Footprint:
    1. Below grade, domestic water CW: Copper, PEX, or PE

3.3 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 220500 - Common Work Results for Plumbing.

3.4 COPPER PIPING INSTALLATION

A. Copper Tube
    1. Solder joints shall be made in accordance with the methods of ASTM B828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B812 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32. The joining of water supply piping shall be made with lead free solders and fluxes. “Lead free” shall mean a chemical composition equal to or less than 0.2 % lead.
    2. Braze all below ground copper tube joints. All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

B. Press Connections: Copper press fittings shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be

checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

C. Rolled/Grooved Connections: Install in accordance with manufacturer’s instructions.

D. Flared Joints: Flared joints for water pipe; shall be made by a tool designed for that operation.

3.5 PEX PIPE INSTALLATION

A. Piping shall be installed per the Installation Standard for PEX Tubing Systems for Hot- and Cold-Water Distribution (IAPMO IS 31), published by the International Association of Plumbing and Mechanical Officials.

B. The Contractor shall demonstrate proficiency in making fitting connections to the satisfaction of the manufacturer's representative. The Contractor shall follow strictly the manufacturer's published instructions covering the recommended procedures for installing PEX piping systems, including handling and storage of piping and fittings.

C. Install piping per pipe manufacturer's recommendations.

D. Do not cut threads into plastic pipe. Use separately purchased thread adapters. Install nipples on metallic valves.

E. PEX piping in exposed areas shall be rigid tube type, with fittings used for all direction changes.

F. PEX piping in concealed areas may be coiled or rigid type.

G. PEX piping installed underground shall be run continuous without any fittings. All PEX fittings shall be located above grade.

H. Provide rigid copper pipe fitting stubs for connections to plumbing fixtures and stops. Pipe fitting stubs shall be rigidly fixed to building structure.

I. PEX-a Piping Systems
   1. Joints in PEX-a piping systems with expansion ring fittings shall be made per ASTM F1960 requirements. Joints shall be made using pipe and fitting manufacturer's approved installation tools.
   2. Installation shall be performed in accordance with the pipe and fitting manufacturer's most recent installation guidelines.

J. PEX-b Piping Systems
   1. Joints in PEX-b piping systems with press fit joints shall be made using pipe and fitting manufacturer's approved ratcheted press tools.
   2. Installation shall be performed in accordance with the pipe and fitting manufacturer's most recent installation guidelines.

3.6 FIELD QUALITY CONTROL

A. Inspect water distribution piping:
   1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the appropriate authority having jurisdiction.
   2. During progress of the installation, notify the plumbing official having jurisdiction at least two (2) working days prior to the time inspection must be made. Perform tests specified below in the presence of the Plumbing Inspector.
      a. Ground work Inspection: Arrange for inspection of all plumbing systems located beneath any poured concrete slabs or foundations.
      b. Roughing-In Inspection: Arrange for inspection of piping system before concealed or closed-in after system roughing-in and prior to setting fixtures.
      c. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
   3. Re-inspections: When a Plumbing Inspector finds that piping system will not pass test or inspection, make required corrections and arrange for re-inspection by the Plumbing Inspector.
   4. Reports: Prepare and submit inspection reports signed by the Plumbing Inspector.

B. Testing water distribution system:
   1. Test for leaks and defects in new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
   2. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved for testing.
   3. Cap and subject the piping system to a static water pressure of 50 psi above the operating pressure without exceeding pressure rating of piping system materials. Isolate test-source and allow it to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
   4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

3.7 CLEANING:

A. Clean and disinfect water distribution piping:
   1. Purge new potable water distribution piping systems and parts of existing potable water systems that have been altered, extended, or repaired prior to use.
   2. Use purging and disinfecting procedure prescribed by authority having jurisdiction or, if a method is not prescribed by that authority, the procedure described in either AWWA C651 or AQQA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill system or part thereof with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) and allow it to stand for 24 hours.
c. Drain system or part thereof of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine. Isolate and allow it to stand for 3 hours.
d. Flush system with clean, potable water until chlorine does not remain in water coming from system following allowed standing time.
e. Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by authority shows evidence of contamination.

B. Prepare and submit reports for purging and disinfecting activities.

C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.8 COMMISSIONING

A. Fill water systems.

B. Before operating systems, perform these steps:
1. Close drain valves, hydrants, and hose bibs.
2. Open shutoff valves to full open position.
3. Remove plugs used during testing of piping systems and plugs used for temporary sealing of piping during installation.
4. Check plumbing equipment and verify proper settings, adjustments, and operation.
5. Do not operate water heaters before filling with water.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.
7. Energize pumps and verify proper operation.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Strainers.

B. Trap Primers.

C. Dielectric Connections.

D. Automatic Air Vents.

E. Water Hammer Arrestors.

F. Pressure Reducing Valves.

G. Backflow Preventers.

H. Wall Hydrants.

1.2 REFERENCE STANDARDS

A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.

B. American National Standards Institute (ANSI)
   1. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment

C. American Society of Sanitary Engineers (ASSE)
   1. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers
   2. ASSE 1015 - Double Check Backflow Prevention Assembly
   3. ASSE 1020 - Vacuum Breakers, Anti-Siphon, Pressure Type

D. International Association of Plumbing and Mechanical Officials (IAPMO)
   1. Uniform Plumbing Code (UPC)

E. National Safety Foundation (NSF)
   1. NSF 61 - Drinking Water System Components

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Required Submittals:
    1. Product data.
    2. Test and Inspection Reports:
        a. Completed manufacturer's startup checklist and report.
    3. Project record documents.
    4. Operation and maintenance data.
    5. Warranty information:
        a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

C. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal procedures.

B. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 STRAINERS

A. Strainer element shall be removable without disconnection of piping.

B. Water: Strainers shall be wye-type with easily removable cover and brass strainer basket.

C. Body:
    1. 1/2 - 2-1/2 NPS: Brass or bronze.
    2. 3 NPS and Larger: Cast iron, semi-steel, brass, or bronze.

D. Accessories:
    1. Provide blowdown valves for strainers. Blowdown valves shall be ball valves with 3/4 inch hose connection and thread-on hose cap.

2.2 TRAP PRIMERS

A. J.R. Smith, PPP Inc., or equal.

2.3 DIELECTRIC CONNECTIONS

A. Union Type.

B. Flange Type.

2.4 AUTOMATIC AIR VENTS:

A. Float type with isolating valves, brass or semi-steel body, copper float, stainless steel valve and valve seat. Suitable for system operating temperature and pressure, but not less than 80 PSIG.

2.5 WATER HAMMER ARRESTORS

A. Stainless steel shell and bellows, nitrogen pressurized compression chamber, Jay R. Smith Hydrotrol or approved equal.

2.6 PRESSURE REDUCING VALVES

A. Single-seated, for dead end service for 30lb to 125lb range on low-pressure side. Composition diaphragm and stainless steel springs, bronze body with threaded connections for sizes 1/2 - 2 NPS, cast iron or semi-steel body with brass or bronze trimmings and flanged connections for sizes 2-1/2 - 4 NPS.

B. Operation: Diaphragm and spring to act directly on valve stem. Delivered pressure shall vary not more than 1lb for each 10lb variation on inlet pressure.

C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

D. Connections at Valves And Strainers: Install shut off valve on each side of reducing valve and full sized bypass with shut off valve. Install strainer on inlet side of, and same size as pressure reducing valve. Install pressure gauge on low pressure side of line.

2.7 BACKFLOW PREVENTERS

A. Install backflow preventers per the requirements of the Uniform Plumbing Code; Article 603 "Cross Connection Control". All backflow preventers shall be listed by the State of Washington, Department of Health, as an approved cross-connection control device.

B. Pressure Type: ASSE 1020

C. Atmospheric Vacuum Breaker: ASSE 1001

D. Double Check Detector Backflow Prevention Assembly, Fire service: ASSE 1015.

E. Double Check Valve Assemblies, Reduced Pressure, 3/4 - 2 NPS
   1. Bronze body construction.

2. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs.
3. Seats and seat discs shall be replaceable in both check modules and the relief valve.
4. There shall be no threads or screws in the waterway exposed to line fluids.
5. Service of all internal components shall be through a single access bronze cover secured with stainless steel bolts.
6. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511-92; CSA B64.4.
7. Provide with the following accessories:
    a. Four resilient seated test cocks.
    b. Two resilient seated quarter turn ball valves for isolation.
    c. Bronze strainer at inlet.
    d. Airgap fitting for relief discharge.

F. Double Check Valve Assemblies, Reduced Pressure, 1 - 3 NPS
1. Bronze body construction.
2. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs.
3. Seats and seat discs shall be replaceable in both check modules and the relief valve.
4. There shall be no threads or screws in the waterway exposed to line fluids.
5. Service of all internal components shall be through a single access bronze cover secured with stainless steel bolts.
6. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511-92; CSA B64.4.
7. Provide with the following accessories:
    a. Four resilient seated test cocks.
    b. Two resilient seated quarter turn ball valves for isolation.
    c. Bronze strainer at inlet.
    d. Airgap fitting for relief discharge.

G. Double Check Valve Assemblies, Reduced Pressure, 2-1/2 - 10 NPS
1. Steel or cast iron construction with epoxy coated and lined check valves.
2. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves and captured springs. Backsiphonage protection shall include provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel.
3. The Lead Free* Reduced Pressure Zone Assembly shall comply with state codes and standards, where applicable, requiring reduced lead content.

4. The assembly shall meet the requirements of ASSE Std. 1013; AWWA Std. C511-92; CSA B64.5; and UL Classified File No. EX3185. Listed by IAPMO (UPC). Approved by the Foundation for CrossConnection Control and Hydraulic Research at the University of Southern California.
5. Provide with the following accessories:
    a. Four resilient seated test cocks.
    b. Two resilient seated non-risting stem gate valves for isolation.
    c. Two resilient seated, UL/FM approved outside stem and yoke valves for isolation.
    d. Cast iron strainer at inlet.
    e. Airgap fitting for relief discharge.

2.8 WALL HYDRANTS

A. Freezeproof
    1. Box type with integral vacuum breaker.
    2. Box shall be locking type, with specific key required for opening and to operate wall hydrant.
    3. Provide with stainless steel vandal-proof hardware.
    4. Provide with vandal resistant keyed operators.

2.9 PIPE-MOUNTED HYDRANTS

A. Provide with stainless steel vandal-proof hardware.

B. Provide with vandal-resistant keyed operators.

PART 3 EXECUTION

3.1 STRAINERS

A. Provide strainers at all of the following locations, in addition to all locations indicated on the drawings:Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings.
    1. High pressure side of pressure reducing valves.
    2. Suction side of pumps.
    3. Inlet side of indicating & control instruments.
    4. Inlet side of equipment subject to sediment damage.

B. Provide blowdown valves with 3/4 inch hose connections at all strainer locations.

3.2 DIELECTRIC CONNECTIONS

A. Provide dielectric connections at all connections between ferrous and non-ferrous pipe:
    1. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation.
    2. Large Bore Pipe: Provide dielectric flanges.

3.3 AUTOMATIC AIR VENTS

A. Locate automatic air vents at high points in piping system.

B. Where air vents are located in inaccessible locations, covered locations, or in locations where leakage could potentially damage the building in any way, provide drain piping from the air vent to the nearest approved indirect drain receptor.
   1. Drain piping shall not be run to drain locations in public areas.

3.4 WATER HAMMER ARRESTORS

A. Provide water hammer arrestors at all of the following location(s):
   1. All restroom piping groups.
   2. Water header assembly.

B. Size and provide in accordance with the Manufacturer's Instructions.

3.5 PRESSURE REDUCING VALVES

A. Set discharge pressure of pressure reducing valves as follows:
   1. General use: 60-80 psig.

3.6 BACKFLOW PREVENTERS

A. Provide isolation valves and strainers for all backflow preventer assemblies.

B. Route discharge pipe from pressure-reducing type backflow preventer assemblies from air gap fitting at assembly to the nearest floor drain, floor sink, or other approved drain location.
   1. Pipe shall not be routed across floor or in other manner that creates a tripping hazard or otherwise obstructs the area.

3.7 TRAP PRIMERS

A. Provide trap primers and primer connections for all of the following:
   1. Floor drains.
      a. Floor drains with waterless trap seals shall not require trap priming connections.
   2. Trench drains.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast iron piping.

B. Plastic piping.
   1. PVC piping.

1.2 REFERENCE STANDARDS

A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.

B. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

C. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

E. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

F. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

G. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

H. CSA CAN/CSA B602M - Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer Pipe.

I. IAPMO IS 1 – Non-Metallic Building Sewers.

J. IAPMO IS 9 – PVC Building Drain, Waste and Vent Pipe and Fittings.

K. UPC - Uniform Plumbing Code

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Required submittals:
    1. Product data.
    2. Project record documents.
    3. Warranty information:
        a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Buried piping shall comply with requirements of utility provider.

C. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

D. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal procedures.

B. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 CAST IRON PIPE AND FITTINGS

A. Soil, Drain, Waste, & Vent Piping: Standard weight bell and spigot cast iron (ASTM A74) or hubless cast iron (ASTM A888/CISPI 301)

B. Bell & Spigot Fittings: ASTM A74 with ASTM C564 compression gaskets

C. Hubless Fittings: ASTM A888 or CISPI 301
    1. Couplings: CISPI 301, ASTM C1277, or ASTM C1540
    2. Elastomeric Sealing Sleeve: ASTM C564, CISPI HSN 85, or CSA CAN/CSA B602M, with center stop

2.2 PLASTIC PIPE AND FITTINGS

A. All material references are found in the International Association of Plumbing and Mechanical Officials (IAPMO) "Uniform Plumbing Code" (UPC), all references are those in force by the Authority Having Jurisdiction at the date of bid.

B. Building Drainage, Waste and Vent:

1. Materials for Poly-Vinyl-Chloride (PVC) Plastic drain, waste and vent pipe and fittings shall be as specified in IAPMO Installation Standard (IS) 9, "PVC Building Drain, Waste and Vent Pipe and Fittings").

PART 3 EXECUTION

3.1 GENERAL

A. All main vertical soil and waste stacks shall be installed with provision for expansion and shall be extended full-size to and above roof lines as vents, except where otherwise specifically indicated.

B. All vent pipe openings on the roof shall terminate not less than 10'-0" horizontally and 1'-0" vertically above any opening to the building or outside air intake opening.

C. Where practical, two or more vent pipes shall be connected together and extended as one pipe through roof. Vent pipes in roof spaces shall be run as close as possible to underside of roof, with horizontal piping pitched down to stacks without forming traps in pipes, using fittings as required.

D. Vertical vent pipes may be connected into one main riser above vented fixture. Where an end or circuit vent pipe from fixture or line of fixtures is connected to a vent line serving other fixtures, connections shall be located to prevent use of any vent line as a waste.

3.2 APPLICATIONS

A. Within Building Footprint:
   1. Below grade, sanitary sewer, general use: Cast iron
   2. Below grade, vent, general use: Cast iron
   3. Above grade, sanitary sewer, general use: Cast iron

B. Outside Building Footprint:
   1. Below grade, sanitary sewer, general use: PVC

3.3 CAST IRON PIPE INSTALLATION

A. Mechanical Joints for Hubless Cast Iron: Install in accordance with manufacturer’s instructions and CISPI standards.

3.4 PLASTIC PIPING INSTALLATION

A. PVC Building DWV: Install per the installation standard for Non-Metallic Building Sewers (IAPMO IS 1), and the installation standard for PVC Building Drain, Waste and Vent Pipe and Fittings (IAPMO IS 9) as published by the International Association of Plumbing and Mechanical Officials and found in the Uniform Plumbing Code Manual.

3.5 PIPE SLOPE

A. Horizontal drain piping shall be installed with the following minimum pipe slope(s):
   1. 3" and smaller: 1/4" per foot (2%).
   2. 4" and larger: 1/8" per foot (1%).

3.6 ROOF PENETRATIONS

A. Provide manufactured neoprene, santoprene, or similar vent flashing assemblies for all roof penetrations.

B. Vent flashing assemblies shall be compatible with the roof construction where the penetration is located.

3.7 CLEANOUTS

A. Provide cleanouts as specified in Section 221319.

B. Provide cleanouts at all locations required to permit cleaning of all sewer piping. Cleanouts shall be full-sized of pipe, but not larger than 4". This shall include cleanouts at base of all vertical lines, ends of all horizontal main runs, and elsewhere as shown on Drawings. Cleanout openings shall be closed with brass screw plugs. Where cleanouts occur in floor, furnish and install a brass ferrule, complete with screwed brass cover, flush with floor.

3.8 TESTS

A. Sanitary and waste lines shall be tested with water at a pressure of not less than 5 PSI. Duration of test shall be not less than 24-hours, and shall be witnessed by Architect.

B. If any piping is found to leak, all defects shall be remedied and test repeated.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe joints.

B. Backwater Valves.

C. Drains.

D. Cleanouts.

E. Interceptors & Separators.

1.2 REFERENCE STANDARDS

A. American Society of Sanitary Engineers (ASSE)
   1. ASSE 1051 - Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems

B. American Society of Testing and Materials (ASTM)
   1. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials

C. International Association of Plumbing and Mechanical Officials
   1. UPC - Uniform Plumbing Code

D. National Sanitation Foundation International (NSF)
   1. NSF 14 - Plastics Piping System Components and Related Materials

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Required Submittals:
   1. Product data.
   2. Project record documents.
   3. Operation and maintenance data.
   4. Warranty information:
      a. Manufacturer's warranty.
      b. Manufacturer's extended warranty.

1.4 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

C. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal procedures.

B. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE JOINTS

A. Expansion Joints: Waste/Vent/Storm Drain Stacks: JR Smith Model 1710 or approved equal.

B. Flexible Pipe Joints: Waste/Vent/Storm Drain: Metraflex Model 201 or approved equal.

2.2 BACKWATER VALVES

A. Flap type, hinged or pivoted, with revolving disc. PVC or ABS body with cleanout of sufficient size to permit removal of interior parts. Hinge, pivot, disc and seat shall be PVC or similar construction. Normal position of disc shall be slightly open. Extend the cleanout to the finished floor or grade and fit with threaded countersunk plug.

2.3 DRAINS

A. Drains shall be Josam, Jay R. Smith, Sioux Chief, Wade, Zurn, or approved equal.

B. Floor Drains
   1. FD-1, FD-2: Adjustable floor drain with cast iron body, with no-hub outlet and clamping collar for use with waterproof membranes.
      a. Provide with round nickel bronze strainer.
      b. Provide with trap primer connection and vandal proof hardware.
   2. FD-3: Grey ABS top housing with MIP threaded connection. Provide with grey ABS strainer. Provide with FIP threaded adapter for connection to drain piping. Drain housing shall include (3) female threaded brass inserts to accept strainer mounting screws. Provide with tamper resistant 316 stainless steel mounting screws.

C. Trench Drains

1. TD-1: Manufactured trench drain system including polypropylene body, HDPE grating, and vandal-resistant grate fastening system. Grating shall be ADA compliant. Grating shall meet DIN load rating A. Grating shall be heelproof type.

2.4 CLEANOUTS

A. Cleanouts shall be Josam, Jay R. Smith, Sioux Chief, Wade, Zurn, or approved equal.

B. Floor: Duco cast iron body with round adjustable scoriated secured nickel bronze top, gasket seal-ABS countersunk closure plug, complete with flashing flange and clamp.

C. Wall: Duco cast iron caulk ferrule with cast iron countersunk closure plug. Provide with stainless steel cover and screw.

2.5 INTERCEPTORS & SEPARATORS

A. Oil-Water Separators
1. Acid resistant coated interior and exterior fabricated steel oil interceptor, bronze cleanout plug and visible double wall trap seal, removable combination pressure equalizing/flow diffusing baffle and sediment bucket, horizontal baffle, adjustable oil draw-off and vent connections either side, secured gasketed non-skid cover, complete with flow control fitting. Regularly furnished with inlet and outlet in high position.
2. Provide with the following factory options:
a. Acid resistant coated interior and exterior fabricated steel extension section.
b. Heavy duty traffic rated cover, with cover rated for 10,000 lbs maximum safe live load.

PART 3 EXECUTION

3.1 GENERAL

A. Install specialties in accordance with Uniform Plumbing Code, Manufacturer's installation instructions, and local jurisdiction requirements.

3.2 DRAINS

A. Provide the drainage equipment and all piping for a complete drainage system as shown and detailed on Plans.

B. Provide water pipe connections to trap primers and run the primer lines to the drains. Verify location of trap primers with Architect before installing.

C. Refer to Section 22 11 19 for trap primers.

3.3 CLEANOUTS

A. Provide cleanouts as indicated on the plans, and as required by the Uniform Plumbing Code.

B. Provide cleanouts at the locations specified below, regardless of whether or not indicated on the drawings:
   1. Drains Within Buildings: Not more than 100’ apart.
   2. Drains Outside Of Buildings: Not more than 100’ apart.
   3. Changes of Direction Inside Buildings: At each fitting of greater than 45 degrees. Where more than one change of direction occurs in a run of piping, only one cleanout shall be required for each 40’ of developed length of the drainage piping.
   4. Building Sewer Junction: Provide a 2-way cleanout at the junction between the building drain and building exterior sewer. This cleanout shall be located within 5'-0" of the building.

C. Install in accordance with Manufacturer’s instructions.

END OF SECTION

SECTION 22 33 29

SUBMERSIBLE SEWERAGE PUMP SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submersible sewerage pumps

B. Catchbasins

C. Pump control panel

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME)
   1. ASME Section VIII - Pressure Vessels, Division I and II.

B. ASTM International (ASTM)
   1. ASTM A48/A48M - Standard Specification for Gray Iron Castings

C. International Organization for Standardization (ISO)
   1. ISO 1940 - Mechanical Vibration Balance Quality Requirements for Rotors in a Constant (Rigid) State

D. National Electrical Manufacturers Association (NEMA)
   1. NEMA MG 1 - Motors and Generators
   2. NEMA ICS 6-1993 - Industrial Control and Systems Enclosures
   3. NEMA 250 - Enclosures for Electrical Equipment

E. Underwriters Laboratories, Inc. (UL)
   1. UL 508-94 - Safety Industrial Control Equipment

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Submit manufacturers catalog information on pumps, controls and associated components. Provide both performance data and construction specification data for compliance with this specification.

C. Installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for demonstration and training requirements.

D. Project Record Documents: Record actual locations of all components.

E. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Maintain one copy of submittal document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMP AND CONTROLS:

A. Pump:
   1. General: Each pump shall be capable of handling raw, unscreened domestic sewage consisting of water, fibrous materials, and 2" diameter spherical solids. The pump(s) shall be capable of handling liquids with temperatures to 104°F continuous, 160°F intermittent, and shall be capable of running dry for extended periods.
   2. Pump construction shall be rated for installation in NEC Class 1, Division 1 locations.
   3. Construction:
      a. The volute, seal plates, and motor housing shall be constructed of high quality ASTM A-48 Class-30 cast iron. The pump (s) shall be painted with a water based air dry enamel of 2.0 mil minimum thickness. All exposed hardware shall be 300 Series stainless steel. The pump construction shall contain no points of critical clearance nor require periodic adjustment or replacement to maintain operating efficiency. Discharge connection shall be a standard NPT in the vertical position. All gaskets shall be of the compression square ring type eliminating critical slip fits and the possibility of damage during service associated with sliding O-Ring sealing arrangements.
      b. The impeller shall be of silicon bronze construction, and shall have a non-clog design with pump out vanes on the back side. The Impeller shall be dynamically balanced to ISO G6.3 Specifications.
      c. The unit shall utilize a single mechanical shaft seal which will operate in an oil atmosphere. The materials of construction shall be carbon for the rotating face and ceramic for the stationary face, lapped and polished to a tolerance of one light band, 300 Series stainless steel hardware, and all elastomer parts to be of Buna-N. The seal shall be commercially available and not a proprietary design of the manufacturer.
      d. The pump shall be designed to be non-overloading throughout the entire pump curve. The rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by 4 threaded fasteners allowing

for easy serviceability. Motor designs incorporating shrink or press fit assembly between the stator and motor housing shall not be acceptable. The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil, making it capable of operating in a totally, partially or non-submerged condition for extended periods of time without damage due to the heat being generated. Air filled motors shall not be acceptable. The motor windings shall be of Class-B insulation. The motor shall meet the standard NEMA Design-L for Single Phase and NEMA Design-B for Three Phase. The motor shaft shall be of 416 stainless steel. The lower bearing shall be of the single ball type to accept radial loads. Bearings shall operate in an oil bath atmosphere for superior life. Permanently lubricated bearings are not acceptable.

e. Thermal sensor shall be used on three phase units to monitor stator temperatures. The stator shall be equipped with a thermal switch embedded in the end coil of the stator winding. This shall be used in conjunction with external motor overload protection and wired to the control panel. Single phase shall have an overload switch on the motor windings and do not require any external protection.

f. The pump shall be equipped with power cable of appropriate length and typed for service intended and connected to the motor via quick disconnect pin terminals. Threaded cord grip type cord entries are not acceptable. Pin receptacles shall be crimped and molded to the power cord in a PVC plug. The plug shall be secured with a stainless steel compression plate to prevent water from entering the housing and to provide strain relief at the point of cable entry. A stainless steel clamp shall compress the PVC molding against the cable jacket to prevent water from entering the jacket. A polybutylene terephthalate terminal block with brass pin inserts shall connect the power cord leads with the motor leads. The ground pin shall be longer than the other pins such that the ground connection is the first connection made and the last connection broken when the plug is inserted and removed, respectively. A Buns-N O-Ring shall provide isolation seating between the terminal block and the motor housing when the cord plug is removed.

    1) Pump Test: The pump manufacturer shall perform the following inspections and test in accordance with the Hydraulic Institute Type-B Standards before shipment from the factory:
        (a) A check of the motor voltage and frequency shall be made as shown on the nameplate.
            (1) A motor and cable insulation test for moisture content or insulation defects shall be made per UL criteria.
            (2) The pump shall be completely submerged and run to determine that the unit meets three per-determined hydraulic performance points.

(3) A written report shall be available showing the aforementioned tests have been performed in accordance with the Specifications.

B. Accessories: Provide all accessories for a complete and functioning assembly including the following manufacturer's standard accessories:
   1. 4/0 galvanized lifting chain.
   2. Breakaway fitting on pump discharge. Fitting shall consist of a cast iron base elbow that is bolted to the floor of the wet well, lower guide rail supports, cast iron movable elbow that rides up and down on the guide rails, a sealing plate with O-Ring seat and galvanized guide plate. The guide rails shall be attached to the base elbow at on end and to a stainless steel upper rail support that shall be attached to the underside of the wet well cover at the top. Barnes 1.25"-3" Break Away Fitting or equal.
   3. 316 Stainless steel pipe rails.
   4. Upper attachment bracket.
   5. Provide a check valve for each pump.

C. Catchbasin
   1. Catchbasin shall be Washington Department of Transportation standard type-2 stormwater catchbasin, of concrete construction.
   2. Catchbasin assemblies, including all components and installation, shall be suitable for AASHTO HS-20 traffic rated applications.
   3. Catchbasin Lids:
      a. Provide with lockable, hinged lid, with pneumatic or hydraulic assist. Lid locking assembly shall be recessed. Lid shall have non-skid surface. Locking assembly shall include hidden handles and padlocks and all components shall be completely flush to lid surface.
      b. Lid(s) shall provide access to entire area of catchbasin.
      c. Lids larger than 4x4' shall be dual-door type, smaller lids may be single- or dual-door.
   4. Accessories:
      a. Provide catchbasin with permanently affixed ladder inside of catchbasin.

D. Control Panel
   1. General: Provide a completely self-contained simplex motor control panel. The control panel shall provide short circuit and overload protection for the pumps.
   2. Enclosure:
      a. The sump pump control panel shall be housed in a NEMA 4X enclosure.
   3. Internal Components & Wiring:
      a. A thermal magnetic circuit breaker shall be provided to protect each motor from short circuits and to serve as a motor branch circuit disconnect as required by the National Electrical Code (NEC).

b. A magnetic starter shall be provided for each pump motor. The starter shall be equipped with a 3-pole bimetallic overload relay with ambient compensation and Class-10, quick trip heaters. Heaters must be properly sized for motor load. The overload relay shall provide the terminals for connection of the pump motor cable.
c. A control transformer shall be provided to supply 115V for the control circuit. The transformer shall be a continuous duty, machine tool type, sized to meet the load requirements of the control circuit. The transformer primary shall be connected to the load side of the circuit breaker. One side of the secondary winding shall be grounded to the component mounting panel.
d. A 2-pole, 600V AC, 30 ampere rated fuse block shall be provided for transformer primary winding; a 1-pole, 250V AC, 30 ampere fuse block will be provided for the secondary winding. Fuses shall be sized to protect the transformer in accordance with requirements of the NEC.
e. A terminal block shall be provided for connection of level controls and other control wiring as required for proper pump installation.
f. The control shall be equipped with a Hand/Off/Auto selector switch and can amber run light, mounted on an aluminum plate under cover of the enclosure door. The selector switch shall be a toggle type with screw terminals rated 250V AC, three amperes. The run light shall be 1/3W 115V neon type.
g. The control shall be wired in accordance with all applicable requirements of the National Electrical Code. Control wiring shall be 16AWG red for control circuits and white for neutral ground conductors. Power wiring shall be a minimum of 14AWG black. Each conductor shall be numbered. The ends of all wires shall be tinned with 60/40 lead tin alloy solder. All wiring shall be performed in a neat and orderly manner.

4. Provide the following manufacturer's standard accessories:
   a. Alarm light in vapor proof fixture with a 40W flashing red light (shipped loose).
   b. Weatherproof 4" square vibrating alarm horn which produces 96db at 10' with alarm silence switch and red high waters indicator light that stays on until water goes down.
   c. Float switches for installation in catchbasin.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install all components in accordance with manufacturer's instructions and all requirements of the Authority Having Jurisdiction.

B. Install pumps & rail mounting systems to allow pumps to be accessed & serviced from the open lid at the top of the catchbasin.

3.2 ELECTRICAL WORK

A. Provide all wire and conduit between the control panel, pumps, and float switches. Wiring between devices in catchbasin (including pumps & float switches) and control panel or junction box located in mechanical room above catchbasin flood rim shall be continuous, without splices.
   1. Provide 36" extra (minimum) float switch wiring length so that float switch depth(s) can be adjusted/lowered after installation. Coil extra wire near top of catchbasin and zip-tie to keep wiring in place. Initial float switch locations shall be as indicated on drawings.

B. All wiring, junction boxes, and accessories located in catchbasin shall be suitable for submersible applications and fully gasketed & sealed to prevent water or moisture intrusion.

C. All wiring, junction boxes, and Accesses located in catchbasin shall be suitable for installation in NEC Class 1, Division 1 locations.

3.3 CATCHBASINS

A. Install catchbasin per Washington State Department of Transportation requirements.

B. Catchbasin installation shall be suitable for AASHTO HS-20 vehicle-traffic-rated location.

C. Provide vent pipe for all catchbasins. Vent pipe shall be terminated above the flood rim of the catchbasin.
   1. Vent pipe shall be schedule 40 PVC or ABS DWV piping. Vent pipe shall terminate with cast iron DWV vent pipe (transition to cast iron pipe minimum 18" below grade) with downturned pipe elbow with insect screen at opening. Vent opening shall be 18-24" above grade.
   2. Vent pipe shall be 3" nominal size.
   3. Locate exposed portion of vent within 6" of adjacent building.
   4. Paint exposed vent pipe to match adjacent building.

3.4 TEST

A. Make tests under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test.

END OF SECTION

SECTION 22 33 36

ELECTRIC COMMERCIAL WATER HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Instantaneous electric water heaters.

1.2 REFERENCE STANDARDS

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
   2. ASHRAE 90A – Energy Conservation in New Building Design

B. American Society of Mechanical Engineers (ASME)
   1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels

C. International Association of Plumbing and Mechanical Officials (IAPMO)
   1. UPC - Uniform Plumbing Code

D. National Fire Protection Association (NFPA)
   1. NFPA 70 - National Electrical Code (NEC)

E. Underwriters Laboratories (UL)
   1. Building Materials Directory

1.3 SUBMITTALS

A. Refer to Division 1 and Section 220500 for submittal procedures.

B. Required Submittals:
   1. Product data.
   2. Test and Inspection Reports:
      a. Completed manufacturer's startup checklist and report.
   3. Project record documents.
   4. Operation and maintenance data.
   5. Warranty information:
      a. Manufacturer's warranty.

C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations. Provide performance and general equipment specification data.

1.4 QUALITY ASSURANCE

A. Conform to ASME Section VIII for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 and the Washington State Energy Code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal procedures.

B. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. All water heaters shall meet the requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90A and be so labeled. Controls shall not allow water temperature to exceed 210 degrees F. All water heaters shall comply with the efficiency provisions of the Washington State Energy Code.

B. All heaters shall be NEC certified.

C. Heaters shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable settings for the intended use.

D. A separate switch shall be provided to permit turning off the energy supplied to electric service water heating systems.

E. Provide a 12-year (minimum) anode on all water heaters.

2.2 INSTANTANEOUS TYPE ELECTRIC WATER HEATERS

A. Microprocessor-based instantaneous electric water heater. Microprocessor shall sample the water temperature a minimum of 120 times per second. Maximum output temperature shall be preset at factory. Housing shall be satin-finished stainless steel. Heating element shall be fabricated from Celcon plastic. Heating coils shall be

nichrome. Heater shall be supplied from factory with faucet flow control and compression fittings.

B. Heater shall be operable down to 0.5 GPM water flow and with a minimum water pressure of 25 PSI.

C. Heater shall be UL listed, and meet UPC standards with respect to construction, installation and accessibility.

PART 3 EXECUTION

3.1 GENERAL

A. Install heaters per manufacturers published installation instruction and the requirements of Chapter 5 of the Uniform Plumbing Code. This includes seismic anchoring.

END OF SECTION

SECTION 22 45 00

EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Eyewash equipment.

1.2 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

C. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

PART 2 PRODUCTS

2.1 EYEWASH EQUIPMENT

A. ANSI Z358.1, wall-mounted bowl with dual eye-spray head assembly.

B. Pipe and Fittings Material: Epoxy coated galvanized steel.

C. Valve: Full flow, self close, quick to open using wide-handle manual hand operator.

D. Drain: Built-into the bowl assembly with 1-1/4 inch female outlet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

B. Verify that deck, wall and floor finishes are prepared and ready for fixture installation.

3.2 INSTALLATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.3 FIELD QUALITY CONTROL

A. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.4 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.5 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General requirements for Division 23 (HVAC).

1.2 SUMMARY

A. Section includes all general requirements that apply to the entirety of Division 23 - HVAC, both interior and exterior to the building, as indicated on the plans and specified herein.

B. All specification sections with Division 23 - HVAC are complementary. All specification sections within Division 23 shall be considered to reference each other.

C. Provide all HVAC work as indicated in the drawings and specified herein.

1.3 REFERENCE STANDARDS

A. American Institute Of Steel Construction (AISC)

B. International Code Council (ICC)
   1. IMC - International Mechanical Code
   2. IBC - International Building Code
   3. IFC - International Fire Code

C. National Fire Protection Association (NFPA)
   1. NFPA 70 - International Electrical Code

D. Sheet Metal And Air Conditioning Contractors' National Association (SMACNA)
   1. SMACNA 1650 - Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition
   2. SMACNA 1966 - HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

E. Underwriters Laboratories (UL)
   1. Building Materials Directory

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide product data for all components and equipment provided under this Division.
   1. Product sheets with more than one item or option shown shall have the product(s) and options to be used on the project clearly identified.

2. Any equipment or materials installed or furnished without prior approval of the Owner's Representative shall be rejected and such materials will be required to be removed and replaced with approved materials at the expense of the Contractor.

C. Shop Drawings:
   1. Shop drawings shall be submitted for review and approval prior to beginning work.
   2. Shop drawings shall indicate routing of piping and location of all equipment to be provided, and shall reflect coordination with other disciplines and existing conditions.

D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports, inspection reports, and commissioning reports.

F. Project Record Documents:
   1. Record actual routing of installed piping and ductwork, including elevation (or depth for buried items).
   2. Record actual equipment and components installed, as well as locations.
   3. RFI's, change orders, and the like shall be noted on the Record Documents where these affect the layout or other aspect of project shown on the documents. References to these shall include the RFI/change order number as well as written description(s), sketch(es), etc., indicating the change or clarification.
   4. Record actual location of installed valves, sensors, dampers, and other control components.
      a. Include riser diagram(s) and schedule of valve tags and locations.
   5. Record actual location and type of vibration isolation devices.
   6. Final record documents:
      a. Upon completion of the project the as-built information shall be neatly transferred to a clean set Plans. This set of Plans shall be submitted for final approval and acceptance.

G. Operation and Maintenance (O&M) Data:
   1. Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.
   2. Include manufacturer's warranty information, including any extended warranties, or certifications of warranties required for specific products, systems, or installations.
   3. Include certification of inspection(s) from the Authority Having Jurisdiction for the applicable work scope(s).
   4. Include certification of training.

5. Include certification of Contractor's one-year warranty of materials and workmanship, including effective date(s) of warranty period.

H. Seismic support calculations and any related required certification(s).

I. Warranty Information:
   1. Certificate of installing contractor's one-year warranty.
      a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
   2. Certificate of product manufacturer's warranty.
      a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).

1.5 QUALITY ASSURANCE

A. Manufacturer: A company specializing in manufacturing products specified in Division 23 with a minimum of three years documented experience.

B. Contractor: Mechanical work required under this Division shall be performed by a Washington State Licensed Mechanical Contractor.

C. Electrical work required under this Division shall require an Electrical Permit.
   1. Electrical permit shall be procured by the Division 23 contractor or their electrical subcontractor.

D. Electrical Equipment
   1. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection(s), such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., shall be provided with an approved label from either Underwriters Laboratories (UL), the American Gas Association (AGA) or the Canadian Standards Association (CSA).
   2. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector.

E. Performance Certification: All equipment performance (airflow, heating capacity, cooling capacity, etc.) shall be certified by a recognized national agency such as the Air Conditioning and Refrigeration Institute (ARI), Air Movement and Control Association (AMCA) and the American Society of Mechanical Engineers (ASME).

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.

C. Protect products from weather and moisture. Provide coverings of plastic or canvas. Cover openings into pipe and duct. Isolate components from contact with the soil. Provide a means of heating for those components that may become damaged by high or low temperatures.

D. For extended outdoor storage, remove motors and other electrical equipment from enclosures not designed for outdoor use and store separately.

1.7 DEFINITIONS

A. The term "approved equal" means final approval by the Architect of a material or piece of equipment substituted for that which is shown in the Specifications or Plans.

B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

C. The term "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refer to those subcontractors working under the direction of the General Contractor (GC).

1.8 MISCELLANEOUS REQUIREMENTS

A. Intent of Drawings
   1. The drawings are intended to depict the general scope of arrangement. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in ductwork and piping. Provide additional fittings, offsets and extensions in piping, ductwork and related items to provide full systems functionality and to assure access for equipment maintenance and as detailed elsewhere in the contract. Relocate or shift piping and ductwork where conflict exists with other plumbing or mechanical systems, structural elements, architectural elements, or electrical systems, or other project work scope(s). Report conflicts before proceeding with work. Provide reasonable planning and layout in advance of installation in order to avoid conflicts and delays. The Contractor will be directed to adjust systems due to conflicts that could have been reasonably foreseen at the Contractor’s own expense.
   2. Examine the Architectural, Structural, Electrical, and other project drawings before work is started. Consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to provide reasonable coordination shall result in the Contractor, at his own expense, moving his work to provide the necessary space for the other Contractors.

B. Permits and Fees: Obtain and pay for all permits and construction fees. Furnish Final Certificate to Owner showing compliance with code requirements.

C. Scheduling: Comply with requirements of Division 1.

D. As-Specified Equipment: These specifications and drawings generally list only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition the listed product is the basis of the design regarding physical size, capacity, electrical power requirements and performance. The product so identified is designated "as specified."

E. Prior Approvals:
   1. Specifications have been written around equipment and materials selected for this project based on quality, size, capacity, and performance required to meet building design criteria. All equipment and materials used in this project that have been specified around a specific product or products shall have prior approval for product substitutions.
   2. Request for Approval must be submitted in accordance to Division 1 requirements,
   3. Supplier and/or Mechanical Contractor shall be responsible to ensure that substituted material or equipment is of same size, quality, capacity, weight and electrical characteristics as that specified or shown on the drawings. Any changes and cost increases required during construction due to substituted equipment shall be paid by the Contractor/Supplier. Prior approval to bid does not mean final approval of material or equipment. Final approval will be given after final submitted data has been presented, complete with full information regarding weights, capacities, size, electrical requirements and quality.

F. Contractor's Cost Breakdown: Submit a cost breakdown (schedule of values) of the major portions of the work. Provide this submittal along with the equipment submittals. Organize the costs generally by specification section. For example, if one Section (such as copper piping) applies to both plumbing and hydronics, apportion the appropriate amount to each area of work.

1.9 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for general demonstration and training requirements.

1.10 REQUESTS FOR INFORMATION

A. Refer to Division 1 for Request for Information (RFI) requirements.

PART 2 PRODUCTS

2.1 DAMAGED OR REJECTED MATERIALS

A. Damaged or rejected materials shall be removed from the site immediately upon discovery.

2.2 FIRE INTEGRITY

A. All mechanical system penetrations of fire rated assemblies shall be protected in accordance with the building code in force in the Authority Having Jurisdiction for this project. This includes piping, ductwork, supports, conduit, and any other system and appurtenance provided by Division 23. In addition, all through-penetration sealing methodologies shall be listed in the Underwriter's Laboratories (UL) Fire Resistance Directory, issue current at time of bid.

PART 3 EXECUTION

3.1 CODE COMPLIANCE

A. The Contractor shall comply with all applicable codes and requirements including but not limited to:
   1. International Building Code, including local amendments.
   2. International Fuel Gas Code, including local amendments.
   3. International Mechanical Code, including local amendments.
   4. International Fire Code, including local amendments.
   5. Uniform Plumbing Code, including local amendments.
   6. National Electrical Code (NFPA 70), including local amendments.
   7. Washington State Energy Code
   8. Requirements of the local Authority Having Jurisdiction (AHJ).
      a. Authority Having Jurisdiction: City of Redmond.

3.2 LAYING OUT WORK

A. Locate all general reference points and take such action as is necessary to prevent their destruction lay out work and be responsible for all lines, elevations, grading for utilities and other work required under the Contract. Exercise proper precaution to verify figures shown on drawings before laying out work and be responsible for any error resulting from failure to exercise such precaution. Coordinate the utility installation with the final site grading and elevations. Locate existing utility lines that will be affected by the building location before any footing work begins. Report conflicts with the Plans before proceeding with the work. Failure to follow reasonable precautions with regards to this instruction will require Contractor to alter the work at the Contractor's expense.

3.3 ELECTRICAL WORK

A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to the NEC and other all applicable codes.

B. All electrical work performed under this Section of the Specifications shall require a permit. Contractor shall obtain and pay for all required permits and fees.

C. All electrical work performed under this Section of the Specifications shall be performed by a electrician licensed in the jurisdiction where the work is performed.

3.4 WORKMANSHIP

A. Furnish and install all equipment in a neat and finished appearance. If any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall remove the equipment, reinstall and patch and paint surrounding surfaces without any increase in cost.

3.5 DUCT INSTALLATION

A. Ductwork shall not be located over electrical panels or switchboards except where located above the structural ceiling.

B. Lay below-grade duct and piping in straight lines with uniform slope. Care shall be taken to keep all foreign materials out of the duct and pipes during installation.

3.6 OPENINGS IN PIPES AND DUCTS

A. Keep closed during the work.

3.7 INSERTS

A. Inserts in concrete for the suspension of piping and equipment shall be provided by this Contractor unless otherwise noted on the Plans. Inserts in "poured in place" concrete shall be Grinnell, Kinsdorf, Elcen, or approved equal. Provide as necessary for support of systems installed.

3.8 CUTTING AND PATCHING

A. General:
   1. Provide all saw cutting, core drilling, and other work (including patching) necessary for installation of mechanical systems.
   2. Prior to cutting, saw cutting, or core drilling any concrete, Contractor shall locate any reinforcing steel (rebar) and the like located in the concrete where the cutting is to be performed. Obtain specific approval from the Architect prior to cutting any concrete reinforcement. Approval must be obtained for each specific instance of cutting reinforcement.

3. Unless directed otherwise by Structural Documents, maintain the following minimum clearances from any concrete reinforcement:
    a. Reinforcing steel: 2”

B. New Work: Provide openings in walls, floors, foundations, etc. for pipe, duct and associated items required for installation under Division 23 are provided.Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample coordination time to avoid delays and unnecessary labor. The expense for cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be borne by this Contractor.

C. Existing Structure:
    1. All necessary cutting and patching of existing structures necessary for the installation of mechanical work shall be as part of this Contract. Unless cutting and patching locations are specifically shown on the drawings, obtain approval prior to proceeding.
    2. All surfaces must be patched upon completion of work. Final finish of all patched surfaces (walls, ceilings, floors etc.) shall be done per finish schedules shown on the Architectural Drawings or patched to match the adjacent surface.
    3. Contractor shall locate all steel in existing structure using x-ray or similar scanning equipment prior to cutting into existing structure.

3.9 MAINTENANCE AND OPERATION ACCESS

A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
    1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
    2. Access door locations; shall be approved by the Architect prior to installation.

B. Access Panels
    1. Provide access panels for all concealed equipment, dampers, and the like that requires adjustment or service access. Panel locations shall be carefully selected on the job so as not to be located behind cabinets, lights, etc.
        a. Coordinate with the work of other Contractors before installing panels.
        b. Panels shall be prime coated and painted to match surrounding surface.
        c. In finished areas, including ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.
        d. Panels shall be size appropriate for the service intended.

e. Provide UL labeled fire rated access doors for one or two-hour rated walls and ceilings.
f. Install before surrounding surfaces have been painted.
g. Access panel doors shall have cylinder lock latch, all keyed alike.
h. Provide access doors in ceiling or wall adjacent to all fire damper locations.
i. Verify with Architect the location and finish of all access panels.
j. Panels shall be J.R. Smith, or equal.

C. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
2. Access door locations; shall be approved by the Architect prior to installation.

D. In addition to building access openings, provide access panels on ducts where required to service fire dampers, damper operators, and other equipment requiring adjustment or maintenance.
1. Duct access openings shall be constructed in accordance with SMACNA Duct Construction Standards, Metal and Flexible.
2. All access doors to mechanically furnished panels, control boxes and filter compartments shall be provided with fully hinged, easily opened access doors.

3.10 TEMPORARY HEATING

A. The Contractor shall be responsible for providing temporary heating for all spaces affected by work under this contract.

B. The Contractor shall coordinate any temporary utility (such as gas, electric, etc.) required to provide temporary heating.
1. The building electrical system may be used.
a. The Contractor shall be responsible for providing temporary electrical connection(s) to the electrical system.
b. The Owner will pay for electrical energy used as part of their normal utility payment.

C. Maintain the following space conditions:
1. General spaces: 60°F
a. During concrete work and curing: Refer to concrete specifications for condition requirements.
b. During painting work and curing: Refer to painting specifications for condition requirements.

2. Natatoriums: 60°F
    a. During pool plaster work and curing: Refer to pool plaster specifications for condition requirements.
3. IT and server rooms: 60-90°F and 20-50% RH

D. Air handling units, unit heaters, and other equipment installed as permanent units under this contract may not be used as temporary conditioning units during construction.

E. Where specifically allowed in writing by the Owner, equipment installed as permanent units under this contract or existing equipment may be used for temporary space conditioning during construction, subject to the following conditions:
1. The building must be clean of all dust before starting units.
2. Temporary filter media (80 % to 85 % efficient) for all return air, fresh air, exhaust and relief air systems shall be provided.
3. All windows, doors or other openings in the building must be closed off.
4. Upon completion of the job, provide new filters for all units, size and type as specified for normal operation of the equipment in Division 23.

3.11 VIBRATION ISOLATORS

A. General: Provide vibration isolation per the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Applications Manual, Chapter “Sound and Vibration Control”. Vibration isolation shall be provided for both isolation from the building structure (devices such as spring hangers, rubber in shear isolators, etc.) and isolation from the mechanical system (devices such as pipe and duct flexible connections). This ASHRAE reference details specifically the method, type of device, and device selection required. Refer to Table 47, “Selection Guide for Vibration Isolation”.

B. Vibration isolation may be combined with the seismic support system, if certified by the isolation equipment manufacturer.

3.12 SEISMIC SUPPORT

A. Ductwork: Support ductwork per the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.

3.13 EQUIPMENT LUBRICATION

A. All air handling equipment including fans, air handling units, DOAS units, heat pumps, and heat recovery units, etc., shall have all lubrication fittings on the equipment exterior.

3.14 FIRE INTEGRITY

A. Maintain the fire rating of all assemblies (wall, ceiling, floor, etc) penetrated by mechanical systems. Provide approved firestopping materials as previously specified, and install in accordance with the conditions of the material UL listing.

3.15 PRESSURE TESTS AND IN-SERVICE TESTS

A. All work under this Contract shall be thoroughly and systematically tested, both during construction and after completion. Testing of systems and/or components shall be either as specified in the appropriate specification section, or as specified in the applicable code. Tests shall be maintained until approved.

B. Notifications shall be sent to the following parties 48 hours in advance of all tests:
   1. Architect.
   2. Owner.
   3. Authority Having Jurisdiction over the specific work to be inspected.
      a. Notifications to AHJ shall be provided in accordance with requirements of each specific AHJ, including amount of advance notice allowed.

C. No systems, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing without first notifying all of the above-listed parties for inspection. Failure to provide such notification of concealed systems shall be cause to require this Contractor to uncover and re-cover such systems at no additional cost.

D. A log of all tests shall be kept. The log shall note date, time of day test started, system or portion of system tested, length of test and test results.

E. The Contractor shall test the completed installation as in regular service. The systems provided under this Contract shall be operated in normal service for a period of at least a week prior to requesting substantial completion inspection, and any resulting defects repaired.

F. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from the date of final acceptance, and shall repair or replace any part which may show signs of failure in that time if such failure is due to imperfections in material or to improper workmanship.

3.16 STARTUP, BALANCING AND COMMISSIONING

A. Equipment Startup
   1. Equipment utilized on this project was installed and started up under an earlier project phase.

B. Testing and Balancing

1. Refer to Section 230593 for testing and balancing requirements.
2. Provide any necessary impeller trimming or other modifications to mechanical equipment required for specified performance.

C. Commissioning
1. Provide system adjustment to demonstrate compliance with design documents. Provide documentation to meet basic commissioning requirements of Washington State Energy Code section C408.

3.17 CLEANING UP

A. Comply with requirements of General Specifications (Division 1, General Conditions, Etc.).

B. Ducts shall be maintained as clean as possible during erection, and shall be blown clean before the building field painting operations are started. Ducts and apparatus casings shall be thoroughly cleaned before fans and filters are operated. After equipment has been used for any purposes, such as adjusting, testing, or temporary ventilation, filters shall be cleaned or renewed and exhaust/return ducts shall be cleaned. Use temporary filters with 80% to 85% filter efficiency during construction.

C. All equipment and material installed shall be properly protected from damage during the course of construction.

D. In utility rooms and other spaces where piping such as condensate drains, heating water, chilled water, or refrigeration lines have been installed at floor level and interfere with foot traffic, the Mechanical Contractor shall provide covers to protect these pipes. Wood or other such material is acceptable. Where duct plenums or duct runs interfere with normal traffic pattern of maintenance personnel, the Mechanical Contractor shall provide a wooden bridge over the ducts to prevent damage. Provide handrails for bridge(s) where required by code.

3.18 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.

B. Repair all damage to the building, systems, or property, caused by the Contractor at no additional cost to the Owner. This provision shall include any preventable damage caused by lack of due diligence in planning and investigation, and shall not be applied to field conditions which could not reasonably be ascertained prior to the activity causing damage.

C. In attic or other spaces where ductwork has been installed at floor level and interferes with foot traffic, the Contractor shall provide permanent covers to protect these items. Wood or other such material is acceptable. Provide handrails where required by code.

3.19 CAULKING

A. Caulk all openings and flash around all ductwork passing through roof, floor, and walls.

B. All caulking shall be water resistant, zero-VOC, zero mold growth, LEED qualified, and water based type.

C. Refer to paragraph "Fire Integrity" for all rated wall, ceiling, roof, floor, and other penetrations.

3.20 FINAL INSPECTION

A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall provide notification. It shall be understood that the work shall be essentially complete, and the open items list provided at that time. The warranty period will not start until the punchlist and back-check are complete. Additional inspections required because of lack of diligence by the Contractor will be conducted on a schedule convenient to the inspectors.

3.21 INSTRUCTION PERIODS

A. Refer to Division 1 for additional demonstration and training requirements.

B. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner’s staff.

C. General Description Of Instruction Period: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, and equipment cleaning procedures, temperature control settings and available adjustments.

D. Scheduling Of Instruction Period: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given at least two weeks prior to the instruction period, and agreement finalized as to the date at which the instruction period is to be performed. Notify two weeks prior to date when ready to conduct instruction and demonstrations receive approvals of proposed date prior to making final arrangements.

E. Comply with training and training reporting requirements enumerated in Chapter 14 of the Washington State Energy Code, WAC 51-11.

3.22 ON SITE OBSERVATIONS AND SAFETY MEASURES

A. The Contractor is solely responsible to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The duty of any other individual or organization to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. The contractor shall be responsible for providing all safety measures and shall consult with the State and/or Federal Safety Agency or Inspector for interpretation whenever in doubt as to compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damages or injury to any persons or property wherever located resulting from any action or operation under this Contract or in connection with the work.

3.23 CONTINUITY OF BUILDING AND UTILITY AND SHUTDOWNS

A. General: Continuity of utilities services in the building shall be maintained at all times as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services shall be accomplished in accordance with the following requirements.

B. Shutdowns:
   1. While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings.
   2. Shutdowns longer than 2 hours shall be coordinated with and approved by the Owner at least 1 week in advance.
   3. Shutdowns less than 2 hours shall be coordinated with and approved by the Owner at least 48 hours in advance.

C. Costs: The Contractor shall include in their bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes or failure to complete utilities connections within authorized shutdown periods.

D. Coordinate with the serving utility and pursue the work in timely manor to return utilities to service.

E. Liability: Failure to coordinate with the serving utility or to sufficiently pursue the work in time to return utilities to service shall not constitute a basis for avoiding any contractual penalties.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

J. FM (AG) - FM Approval Guide; Current Edition.

K. MFMA-4 - Metal Framing Standards Publication; 2004.

L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

M. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

1.5 QUALITY ASSURANCE

A. Comply with applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1 for product delivery, storage, and handling requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.7 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for execution and closeout requirements.

B. Refer to Division 1 for closeout submittal procedures.

C. Refer to Division 1 for general demonstration and training requirements.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
5. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Corrosive Locations: Use 316 stainless steel, or approved equivalent.
    1. Corrosive locations shall include spray park mechanical rooms and chemical storage rooms.

B. Prefabricated Trapeze-Framed Metal Strut Systems:

1. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
2. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
3. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
4. Comply with 1.
5. Strut Channel or Bracket Material:
6. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Strut Channels:

1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

D. Channel Nuts:

1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

E. Hanger Rods:

1. Threaded zinc-plated steel unless otherwise indicated.

F. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

G. Pipe Stanchions:

1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

H. Beam Clamps:

1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
7. Material: 2 carbon steel or 1 forged steel.
8. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
9. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

I. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

J. U-Bolts:

1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

K. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

L. Pipe Hangers:

1. Split Ring Hangers:
    a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
    b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
    c. Provide hanger rod and nuts of the same type and material for a given pipe run.
    d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
2. Swivel Ring Hangers, Adjustable:
    a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.
    b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
    c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.
3. Clevis Hangers, Adjustable:
    a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
    b. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
4. Material: Malleable iron, 1; or carbon steel, 2.
5. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

M. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

N. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
7. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Powder-actuated fasteners are not permitted.
12. Hammer-driven anchors and fasteners are not permitted.
13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of plumbing systems.

1.2 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in I-P (inch-pound) units only.
   6. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Pumps are rotating correctly.

13. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

3.8 SCOPE

A. Test, adjust, and balance the following:
   1. Air Inlets and Outlets.
   2. Hot water recirculation system.

3.9 MINIMUM DATA TO BE REPORTED

A. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.

5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.

B. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.2 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.27 at 75 degrees F, when tested in accordance with 1.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

D. Indoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.3 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

D. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.4 DUCT LINER

A. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Apparent Thermal Conductivity: Maximum of 0.254 at 75 degrees F.
   4. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Duct Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION

SECTION 23 08 10

REQUIREMENTS FOR STARTUP

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide startup and checkout procedures for all Plumbing and HVAC equipment in Divisions 22 and 23.

B. Provide all commissioning documentation in order to comply with the “Systems Commissioning” requirements of the Washington State Energy Code, Commercial (Chapter 51-11C WAC, paragraph C408.2).

1.2 REFERENCE STANDARDS

1.3 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Startup Data
   1. Incomplete items list.
   2. Preliminary systems documentation
   3. Pre-start and startup checklists
   4. Functional performance checklists
   5. WSEC-C Commissioning checklist upon completion, along with the completed pre-start, startup and functional performance checklists.

1.4 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 60 00 for product storage and handling.

1.5 CLOSEOUT REQUIREMENTS

A. Refer to Section 01 70 00 for execution and closeout requirements.

B. Refer to Section 01 78 00 for closeout submital procedures.

C. Refer to Section 01 79 00 for Demonstration and Training.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall prepare a complete list of all items that are not complete prior to notification of readiness for punchlist. This list shall include estimated date of Contractor completion for each item.

B. The Contractor shall coordinate with the Owner for Owner's system operators & maintenance personnel to observe startup procedures.

C. The following procedures shall be performed by the Contractor and their equipment supplier. Also, complete the "Commissioning Compliance Checklist" per the WSEC-C, and provide any information stipulated on that checklist.

3.2 PREPARATIONS

A. Assemble four copies of the preliminary system documentation described below, and submit to the Architect along with the startup and checkout plan. Three copies will be returned to the Contractor.
   1. Startup Schedule, to be integrated with the Construction Schedule.
   2. List of equipment and systems for formal startup.
   3. List of sub-trades, suppliers and other Contractors who will be involved in the startup process.
   4. All submittal data and controls sequence descriptions needed to prepare startup and checkout checklists.

3.3 SYSTEM CHECKLISTS

A. Prepare Pre-Start and Startup Checklists. These checklists shall be based on lists provided in Appendix B of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) "HVAC Systems Commissioning Manual". Level-1, "Basic Commissioning", which is the standard for this Contract. If applicable to the equipment and systems on this project, the SMACNA checklists may be used without modification. If not directly applicable, either modify a similar SMACNA checklist to suit the equipment or system under consideration, or create a new checklist. Any new or modified checklist must have the same level of checkout as the base SMACNA checklist. Pre-start and startup checklists shall include all manufacturer's recommended startup instructions. The manufacturer's instructions shall have priority over SMACNA checklist examples.

B. Prepare functional performance checklists. These checklists shall be based lists provided in Appendix D of the SMACNA "HVAC Systems Commissioning Manual". Again, Level-1, "Basic Commissioning", is the Standard for this Contract. If applicable to the equipment and systems on this project, the SMACNA checklists may be used without modification. If not directly applicable, either modify a similar SMACNA checklist to suit the equipment or system under consideration, or create a new checklist. Any new or modified checklist must have the same level of checkout as the base SMACNA checklist. Functional performance checklists shall include all manufacturer's recommended instructions for performance checkout. The manufacturer's instructions shall have priority over SMACNA checklist examples.

3.4 STARTUP AND CHECKOUT PLAN

A. The startup and checkout plan is composed of the pre-start checklists, startup checklists and functional performance test checklists. The plan also includes the startup schedule, checkout schedule, list of sub-trades, suppliers and other contractors who will be involved in the startup and checkout process and all submittal data and controls sequence descriptions needed to prepare startup and checkout checklists.

B. The startup and checkout plan shall be submitted to the Architect as soon as possible along with the preliminary system information. This will normally occur after the initial Controls Design Submittal (Shop Drawings) has been returned to the Contractor (all equipment has been normally submitted and approved by that time). No later than 3-months prior to substantial completion.

3.5 STARTUP AND CHECKOUT PROCEDURES

A. Perform startup and checkout in accordance with the startup and checkout plan.

B. The completed package shall be submitted for approval prior to acceptance of substantial completion. This package shall include:
   1. Two copies of the preliminary system information.
   2. Completed startup and checkout checklists.

C. Provide an operations instruction and demonstration to the Owner's maintenance personnel in accordance with Chapter 6 of the SMACNA HVAC Systems Commissioning Manual.

3.6 BALANCING

A. Balancing occurs after initial startup, and prior to functional testing. Deficiencies are identified and corrected, controls are calibrated, controls programming is initially set up and verified, and other startup and balancing tasks completed.

B. Refer to Section 23 05 93 – Testing, Adjusting and Balancing, for balancing description.

3.7 DOCUMENTATION

A. Provide all documentation described in paragraph C408 of the Washington State Energy Code, Commercial.

B. Provide completed startup and checkout checklists.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Metal ductwork.

C. Duct cleaning.

1.2 RELATED REQUIREMENTS

A. Section 230130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

B. Section 233319 - Duct Silencers.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. Metal ductwork.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

H. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

I. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

J. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

M. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.6 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:

E. Duct Sealing and Leakage in accordance with Static Pressure Class:

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
   4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
   7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

G. Regulatory Requirements: Construct ductwork to comply with 1 standards.

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, 1 FS Type B, with G60/Z180 coating.

B. Aluminum for Ducts: 2 (1); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with 1.

D. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.

E. Hanger Rod: 1; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

F. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with SMACNA requirements..
   2. Masonry Wedge Expansion Anchors: Complying with SMACNA requirements..
   3. Concrete Screw Type Anchors: Complying with SMACNA requirements..
   4. Masonry Screw Type Anchors: Complying with SMACNA requirements..
   5. Concrete Adhesive Type Anchors: Complying with SMACNA requirements..
   6. Other Types: As required.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with 1 and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA requirements.

2.4 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
   2. Aluminum: Aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

B. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA requirements.

C. Round Duct Connection System: Interlocking duct connection system in accordance with SMACNA requirements..

PART 3 EXECUTION

3.1 APPLICATIONS

A. General use HVAC: Galvanized steel or Aluminum ductwork

B. Spray park mechanical rooms: Aluminum ductwork

C. Chemical storage rooms: Aluminum ductwork

3.2 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

D. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use double nuts and lock washers on threaded rod supports.

3.3 CLEANING

A. Clean thoroughly each duct system. See Section 230130.51.

B. Clean duct system by forcing air at high velocity through duct to remove accumulated dust. Clean half the system at a time to obtain sufficient air. Protect equipment that could be harmed by excessive dirt with temporary filters or bypass during cleaning.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Duct access doors.

C. Duct test holes.

D. Volume control dampers.

E. Miscellaneous Products:
   1. Damper operators.
   2. Duct opening closure film.

1.2 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data.

C. Maintenance and Operations Information.

D. Project Record Drawings: Record actual locations of access doors, test holes, and dampers.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction to match ductwork construction; with individually adjustable blades, mounting straps.

2.2 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.3 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.4 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

C. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.5 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils.
   2. High tack water based adhesive.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

E. Use splitter dampers only where indicated.

F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 00

FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line centrifugal fans.

1.2 REFERENCE STANDARDS

A. American Bearing Manufacturers Association (ABMA):

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc. (AMCA):

1. AMCA 204 - Balance Quality and Vibration Levels for Fans.
2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. Underwriters Laboratories Inc. (UL):

1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions.

1.4 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

E. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

F. Motor Energy Efficiency: WSEC-C

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Divioson 1 for delivery, storage, and handling requirements.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.6 CLOSEOUT REQUIREMENTS

A. Refer to Division 1 for closeout submittal requirements.

B. Refer to Division 1 for execution and closeout requirements.

PART 2 PRODUCTS

2.1 FANS - GENERAL

A. Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive, as indicated on the Drawings. V-belt drives shall be designed for not less than 120 % of the connected driving capacity. Motor sheaves shall be variable pitch for 15 Hp and below and fixed pitch above 15 HP. Variable pitch sheaves shall be selected to drive the fan at a speed, which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration isolation supports or mountings as indicated. Vibration isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.2 IN-LINE CENTRIFUGAL FANS

A. Nonmetallic Inline Fans

1. General

a. Fan units shall be UL listed.

2. Housing

a. Fan housing shall be constructed of UV resistant, flame retardant Polycarbonate (PC) thermo plastic.

b. Fan housing shall be a single piece casing formed by the joining of inlet and outlet pieces via a vibration welding process. The joining process shall not utilize mechanical fasteners, caulk or adhesive, and the seam where the pieces were joined shall be permanent and inherently leak free.

c. Capacitor shall be provided and shall be located within the fan electrical terminal box for easy access. Electrical terminal box shall be water tight.

3. Motor

a. Motorized impeller shall be an external rotor type, class B insulation, totally enclosed PSC Type for maximum efficiency.

b. Motor shall be a permanently sealed self lubricating ball bearing type.

c. Motor shall be equipped with automatic reset thermal overload protection.

d. Motor shall be acceptable for continuous duty.

e. Sufficient service factor shall be provided to ensure long maintenance free operation over maximum load conditions.

4. Wheel

a. Fan wheel shall be of the backward inclined centrifugal type with a well designed inlet venturi for maximum performance.

b. Motorized impeller shall be both statically and dynamically balanced as one integral unit to provide for vibration free performance.

5. Performance

a. Fan air flow performance shall be certified by HVI and licensed to bear the HVI Tested/Certified Performance Logo.

6. Accessories

a. Provide each fan with backdraft damper, motor-rated switch/disconnect, pressure switch for automatic shutoff, and speed controller.

2.3 HARSH ENVIRONMENT APPLICATIONS

A. These requirements are in addition to those noted in sections above for the type of fans used.

B. These requirements shall apply to fans serving the following spaces:

1. Spray park mechanical rooms.
2. Chemical storage rooms.

C. Fans shall be provided with stainless steel fasteners.

D. Backdraft dampers provided with fans shall have aluminum blades and stainless steel shafts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install per manufacturer's recommendations and the requirements of the Authority Having Jurisdiction.

B. Provide speed switches for all ceiling exhaust fans. Speed switches are for the purpose of balancing exhaust air quantities and shall be mounted in the fan housings, except where specifically shown otherwise.

1. Fan motors with integral speed adjustment shall meet this requirement.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers:
   1. Rectangular ceiling diffusers.

B. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, exhaust and return register/grilles.
   3. Ceiling-mounted, supply register/grilles.
   4. Wall-mounted, supply register/grilles.
   5. Wall-mounted, exhaust and return register/grilles.
   6. Wall-mounted, grid core exhaust and return register/grilles.

1.2 REFERENCE STANDARDS

A. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.3 SUBMITTALS

A. Refer to Division 1 for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

A. SD-1
   1. Diffusers shall be aluminum construction.
   2. The diffuser shall consist of:
      a. An outer frame assembly, which facilitates mounting in the application shown in the project plans.
      b. An integral collar that allows connection to the square or rectangular duct.
      c. An inner core assembly consisting of fixed louvers capable of producing the airflow discharge pattern as indicated on the project plans, and shall be fully removable from the installed diffuser frame for access to any dampers or other ductwork components located in or near the diffuser neck.
      d. The inner core assemblies shall be identically constructed so that directional core assemblies providing different airflow discharge patterns may be interchanged between frames if the frame duct connections are the same size.
   3. Mounting Frame:
      a. Surface mount with beveled frame.
   4. Finish
      a. The diffuser face shall have a baked-on powder coat finish.
         1) The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
         2) The paint film thickness shall be a minimum of 2.0 mils.
         3) The finish shall have a hardness of 2H.
         4) The finish shall withstand a minimum salt spray exposure of 1000 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.
         5) The finish shall have an impact resistance of 80 inch-pounds.

2.2 CEILING SUPPLY REGISTERS/GRILLES

2.3 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. EG-1
   1. Construction
      a. Grilles shall be 45 degree deflection fixed louver type, and shall have one set of blades with 3/4 inch on center blade spacing.
      b. The grilles front blade orientation shall be parallel to the long dimension.
      c. The blades and border shall be extruded aluminum construction.

d. The minimum grille size shall be 6 x 4 inches. The maximum grille size shall be 36 x 96 inches.

2. Mounting Frames
   a. A 3/8 inch flat border mounting frame.
3. Finish
   a. All components shall have a baked-on powder coat finish.
      1) The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
      2) The paint film thickness shall be a minimum of 2.0 mils.
      3) The finish shall have a hardness of 2H.
      4) The finish shall withstand a minimum salt spray exposure of 1000 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.
      5) The finish shall have an impact resistance of 80 inch-pounds.
4. Provide with the following options:
   a. Opposed Blade Damper: The register shall be supplied with a coated aluminum opposed blade damper. The damper shall be operable from the register face.
   b. Border Style:
      1) The grille shall be suitable for surface mounting, complete with a border in the following style:
         (a) Surface Mount with 1-1/4 inch flat border.
   c. Fastening:
      1) Concealed bracket.

2.4 WALL SUPPLY REGISTERS/GRILLES

A. SD-2

1. Construction:
   a. Grille material shall be aluminum.
   b. The grille shall have precision mitered corners.
   c. The adjustable airfoil blades shall be secured in place by a stainless steel tensioning wire.
   d. The grilles front blade orientation shall be parallel to the long dimension.
   e. The double deflection cores shall have both sets of blades with ¾ inch on center blade spacing.
   f. The minimum grille size shall be 6 x 4 inches. The maximum grille size shall be 36 x 96 inches.
   g. The grille shall be supplied with a mullion when nominal grille dimensions exceed 20 inches.
2. Finish

a. All components shall have a baked-on powder coat finish.
    1) The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
    2) The paint film thickness shall be a minimum of 2.0 mils.
    3) The finish shall have a hardness of 2H.
    4) The finish shall withstand a minimum salt spray exposure of 1000 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.
    5) The finish shall have an impact resistance of 80 inch-pounds.

3. Mounting Frames:
    a. The grille shall be supplied with a 3/8 inch flat border mounting frame.
4. Provide with the following options:
    a. Opposed Blade Damper: The register shall be supplied with an aluminum with mill finish opposed blade damper.
    b. Border Style:
        1) Surface Mount with 1-1/4 inch flat border.
    c. Fastening:
        1) Concealed fastening.

2.5 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. EG-2
1. Construction
    a. Grilles shall be 45 degree deflection fixed louver type, and shall have one set of blades with 3/4 inch on center blade spacing.
    b. The grilles front blade orientation shall be parallel to the long dimension.
    c. The blades and border shall be extruded aluminum construction.
    d. The minimum grille size shall be 6 x 4 inches. The maximum grille size shall be 36 x 96 inches.
2. Mounting Frames
    a. A 3/8 inch flat border mounting frame.
3. Finish
    a. All components shall have a baked-on powder coat finish.
        1) The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
        2) The paint film thickness shall be a minimum of 2.0 mils.
        3) The finish shall have a hardness of 2H.
        4) The finish shall withstand a minimum salt spray exposure of 1000 hours with no measurable creep in accordance with ASTM D1654, and 1000

hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.

5) The finish shall have an impact resistance of 80 inch-pounds.

4. Provide with the following options:
   a. Opposed Blade Damper: The register shall be supplied with a coated aluminum opposed blade damper. The damper shall be operable from the register face.
   b. Border Style:
      1) The grille shall be suitable for surface mounting, complete with a border in the following style:
         (a) Surface Mount with 1-1/4 inch flat border.
   c. Fastening:
      1) Concealed bracket.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

E. Paint interior of ductwork visible behind air outlets and inlets matte black.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Underground feeder and branch-circuit cable.

C. Service entrance cable.

D. Variable-frequency drive cable.

E. Wiring connectors.

F. Electrical tape.

G. Heat shrink tubing.

H. Oxide inhibiting compound.

I. Wire pulling lubricant.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

E. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

F. Section 31 23 23 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

I. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

J. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2024.

K. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 79 - Electrical Standard for Industrial Machinery; 2024.

N. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

O. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

P. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

Q. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

R. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

S. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

T. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

U. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

V. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

W. UL 2277 - Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Wire Pulling Lubricant: Certification of compatibility with conductors/cables where used with the following insulation/jacket types:

D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
   1. Exceptions:
      a. Use variable-frequency drive cable for connection between variable-frequency motor controllers and associated motors.

C. Service entrance cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. For underground service entrance, installed in raceway.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
         2) Feeders: Copper conductors size 12 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.
   4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

H. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

I. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.
      c. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
      c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

B. Provide equipment grounding conductor unless otherwise indicated.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

2.05 SERVICE ENTRANCE CABLE

A. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2.

B. Conductor Stranding: Stranded.

C. Insulation Voltage Rating: 600 V.

2.06 VARIABLE-FREQUENCY DRIVE CABLE

A. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

B. Conductor Stranding: Stranded.

C. Insulation Voltage Rating: 1000 V.

D. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.

E. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.

F. Provide metallic shielding.

G. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.07 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   5. Aluminum Conductors: Use compression connectors for all connections.
   6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

D. Compression Connectors: Provide circumferential type or hex type crimp configuration.

E. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.08 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant:
   1. Listed and labeled as complying with UL 267.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.

3. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

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

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

I. Terminate cables using suitable fittings.

J. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

K. Install conductors with a minimum of 12 inches of slack at each outlet.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet from each other and any other ground electrode.

F. Service-Supplied System Grounding:
   1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
   2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
8. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
9. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.

H. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.06 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners in accordance with manufacturer's recommended torque settings.

I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Stainless steel rigid metal conduit (RMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Galvanized steel electrical metallic tubing (EMT).

G. Stainless steel electrical metallic tubing (EMT).

H. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 33.16 - Boxes for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2025.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

O. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

P. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

T. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

U. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

V. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

W. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.06 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.

2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
3. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), or schedule 80 rigid PVC conduit where emerging from underground.
4. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, stainless steel rigid metal conduit (RMC) elbows, or PVC-coated galvanized steel rigid metal conduit (RMC) elbows for bends.
5. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
6. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

E. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

G. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

H. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or stainless steel rigid metal conduit (RMC).

I. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC) or stainless steel electrical metallic tubing (EMT).
1. Corrosive locations include, but are not limited to:
    a. Swimming pools and associated equipment areas.
    b. Chemical storage areas.

J. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), or PVC-coated galvanized steel rigid metal conduit (RMC).

K. Flexible Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Provide conduit, fittings, supports, and accessories required for complete raceway system.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
   2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

C. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel or malleable iron.
   5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.08 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.09 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Connectors and Couplings: Use compression/gland or set-screw type.
   3. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

E. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

F. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

J. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide grounding and bonding; see Section 26 05 26.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Underground boxes/enclosures.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 27 26 - Wiring Devices:
   1. Wall plates.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Applications:
a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

E. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

F. Install boxes plumb and level.

G. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

H. Install boxes as required to preserve insulation integrity.

I. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches deep.
   2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

L. Close unused box openings.

M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

N. Provide grounding and bonding in accordance with Section 26 05 26.

O. Identify boxes in accordance with Section 26 05 53.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.

C. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

4. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

C. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
2. Use identification label to identify serving branch circuit for all receptacles.
a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conductors and Cables: Legible from the point of access.
8. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

B. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 24 16 - Panelboards.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 70E - Standard for Electrical Safety in the Workplace; 2027.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
   1. Comply with NFPA 70.

2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
         2) Utility Company: Puget Sound Energy.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
      c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
      d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      e. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
         2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
      f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
      g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Arc Flash and Shock Risk Assessment:
   1. Comply with NFPA 70E.
   2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
   3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
      a. Maximum and minimum utility fault currents.
      b. Maximum and minimum motor contribution.
      c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

E. Study Reports:
   1. General Requirements:
      a. Identify date of study and study preparer.
      b. Identify study methodology and software product(s) used.
      c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
      d. Identify base used for per unit values.
      e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
      f. Include conclusions and recommendations.
   2. Arc Flash and Shock Risk Assessment:
      a. For the worst case for each scenario, identify at each bus location:
         1) Calculated incident energy and associated working distance.
         2) Calculated arc flash boundary.
         3) Bolted fault current.

4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 05 53.
2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
a. Include the following information:
1) Arc flash boundary.
2) Available incident energy and corresponding working distance.
3) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems

D. Section 26 05 33.16 - Boxes for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 05 73 - Power System Studies.

G. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

H. Section 26 51 00 - Interior Lighting.

I. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

F. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
   2. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
   3. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 51 00 and lighting fixture schedule.
   4. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Field quality control reports.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

D. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for duration below. Complete forms in Owner's name and register with manufacturer.
   1. Occupancy Sensors: 5 years.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

2.02 OCCUPANCY SENSORS

A. General Requirements:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and audible sound sensing technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
   5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

B. Ceiling Mounted Occupancy Sensors:
   1. General Requirements:
      a. Description: Low profile occupancy sensors designed for ceiling installation.

2.03 TIME SWITCHES

A. Digital Electronic Time Switches:
   1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. Astronomic Time Switches: Single channel, capable of different schedule for each day of week with additional holiday schedule available to override normal schedule

for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.

3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: Multiple voltage input for 120, 208, 240 or 277 V ac.
8. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 26 05 33.16.

C. Maintain separation of remote-control, signaling, and power-limited circuits.
   1. See manufacturer instructions and Section 26 05 19 for control wiring conductors, wiring methods, and identification requirements.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate; see Section 26 27 26.

H. Provide required supports; see Section 26 05 29.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

3.05 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 43 00 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.

3. Fronts:
    a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.

2.02 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Aluminum.
3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Provide clear plastic circuit directory holder mounted on inside of door.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
    a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
        1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
    b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
    a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

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

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 05 26.

K. Install all field-installed branch devices, components, and accessories.

L. Provide filler plates to cover unused spaces in panelboards.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.

D. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates and covers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Wiring Device Applications:
   1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
   2. Provide GFCI protection for:
      a. Receptacles serving electric drinking fountains.

C. Wiring Device Finishes:
   1. Provide wiring device finishes as described below, unless otherwise indicated.
   2. Wiring Devices Installed in Wet or Damp Locations: White with weatherproof cover.

2.02 WALL SWITCHES

A. General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.03 RECEPTACLES

A. General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   3. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

C. GFCI Receptacles:
   1. General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

4. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.04 WALL PLATES AND COVERS

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard; _____.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

C. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

D. Weatherproof Switch Covers for Wet or Damp Locations: Gasketed, metallic, with externally operable actuating means and corrosion-resistant screws; listed as suitable for use in wet locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 24 16 - Panelboards: Fusible switches.

C. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 26 28 16.16.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

2.02 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

2.03 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet in convenient location in main electrical room unless otherwise indicated.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

F. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Provide required seismic controls in accordance with Section 26 05 48.

F. Install enclosed switches plumb.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

J. Identify enclosed switches in accordance with Section 26 05 53.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 24 16 - Panelboards.

1.03 ABBREVIATIONS AND ACRONYMS

A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.

H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Panelboards: See Section 26 24 16.

2.02 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular or non-modular.
   2. Surge Current Rating: Not less than 50 kA per mode/100 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   5. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency power supply units.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 09 23 - Lighting Control Devices.

E. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

F. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

B. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

F. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.03 EMERGENCY POWER SUPPLY UNITS

A. Description: Self-contained emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

B. Compatibility:
   1. Drivers: Compatible standard, energy saving, and dimming AC LED drivers, including those with end of lamp life shutdown circuits.

C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamps to emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

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

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Fluorescent Emergency Power Supply Units:

J. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 33.16 - Boxes for Electrical Systems.

E. Section 26 09 23 - Lighting Control Devices.

F. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.

G. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.03 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

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

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Install accessories furnished with each luminaire.

G. Bond products and metal accessories to branch circuit equipment grounding conductor.

H. Install lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.04 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 27 05 00
COMMOM WORK RESULTS FOR COMMUNICATIONS

PART 1 GENERAL

1.01 REFERENCES

A. General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections.

B. Architectural, Electrical, and Technology Drawings. Other systems drawings may apply. Division 26 Basic Electrical Materials and Methods sections apply to the work of this section.

1.02 RELATED WORK

A. 27 05 26 – GROUNDING AND BONDING FOR TELECOMMUNICATIONS SYSTEMS

B. 27 05 33 - RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

C. 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

D. 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

E. 27 11 16 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

F. 27 11 19 - COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

G. 27 11 26 - COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

H. 27 13 23 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

I. 7 13 23.13 - COMMUNICATIONS OPTICAL FIBER CABLE SPLICING AND TERMINATIONS

J. 27 16 19 - COMMUNIICATIONS PATCH CORDS, STATION CORDS AND CROSS CONNECT WIRE

1.03 SUMMARY

A. The term “provide” used throughout this specification and drawings shall mean “furnish, install, test, and certify”.

B. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Construction Manager and/or General Contractor and all necessary trades to ensure successful completion of work.

C. Phasing, temporary distribution/equipment, cut-over and implementation shall be coordinated with the Architect and the Office of Information Technology (OIT), Construction Manager and/or General Contractor, Architect, and Engineer

D. Extent of communications raceway infrastructure work is indicated by Division 27 specifications and Technology drawings and schedules and is hereby defined to include, but not by way of limitation, the provisions of:

1. Raceway systems including but not limited to conduits, cable trays, sleeves, surface raceways, telecommunication services entrance, manholes, pull-boxes, junction boxes, back-boxes, etc. as required and specified in Division 27 sections and select Division 26 sections. The Construction Manager and/or General Contractor shall coordinate this with the Sub-Contractor performing work and determine how scope of work is assigned. The purpose of this specification is to establish design intent and general system scope.
2. All communications raceway infrastructure (i.e. pathways and spaces) shall be provided as part of the Base Building Project including:
    a. Communication room hardware and component fit-out including cable tray, backboard, and raceways.
    b. Grounding and bonding of all metallic hardware components to the nearest telecommunications grounding bus (TGB) bar including but not limited to equipment racks, cabinets, cable trays, ladder rack, conduits, sleeves, metallic ductwork, and frames.

c. Fire stopping as required. Contractor shall provide fire stopping for all low-voltage openings (including empty low voltage raceway) once cable installation is complete. Confirm specific fire stopping scope requirements with General Contractor and/or Construction Manager.
d. Testing of the grounding systems as noted by specification, drawings, and applicable industry standards. Submit written testing results to OIT.
e. Labeling of all communication infrastructure components with mechanically printed labels.
f. Preparation and submission of product data, shop drawings, testing reports, as-built drawings, and cabling documentation as required in this specification.
g. Construction and Installation warranties.
h. Manufacturer components, channel and solutions warranties.
i. Installation and testing of all system and components.
j. Onsite administrative and user training.
k. Manufacturer training of components.

1.04 SUBMITTALS

A. General Description and Requirements
1. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.
2. Communications Project Manager Responsibilities:
a. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
b. Coordinate with related work indicated on drawings or specified.
c. Manage work related to telecommunications system installation in a manner approved by manufacturer.
3. In addition to the requirements noted herein, refer to Division 1 Specification for additional requirements. As a minimum, Contractor shall ensure all requirements listed here are met.
4. Within 45 days after award of contract or as dictated by the construction schedule (whichever period of time is shorter), the Contractor shall submit prefabrication submittals consisting of product data and shop drawings for approval. Partial submittals will not be accepted without prior written approval from the Architect.
5. Review of the Prefabrication Submittals by the Architect is for purposes of tracking the work and contract administration and does not relieve the Contractor of responsibility for any deviation from the Contract Documents, or from providing equipment and/or services required by the Contract Documents which were omitted from the prefabrication submittals.
6. No portion of the project shall commence nor shall any equipment be procured until the prefabrication submittals have been approved in writing by the Architect. All installations shall be in accordance with the Contract Documents.
7. A detailed completion schedule shall be submitted with the prefabrication submittals.
8. Prefabrication submittals shall be accompanied by a letter of transmittal identifying the name of the project, Contractor's name, date submitted for review, and a list of items transmitted.

B. Product Data
1. Compliance Matrix: Provide full specification compliance matrix as described in the Specification Response section of this specification section.
2. Warranty Information: Provide all warranty information as described in this specification section for review and approval.
3. Component List: Provide complete submittal component list at the beginning of the submittal package. Component list shall identify each component name, manufacturer, and specific product/part number. All part numbers shall clearly indicate special options, color, accessories, etc. Component list and manufacturer cut-sheets shall be compiled to match the order of each Appendix.

4. Cut-Sheets: Submit manufacturer's cut-sheets on all components listed within this specification and corresponding appendix. All components and parts being used shall be highlighted in color on cut-sheets to distinguish specific product/part numbers, options, colors, accessories, etc.
5. performance based, thus all products listed in Appendix 1: Equipment Schedule are benchmark products. The Contractor shall include the listed benchmark product lines in the initial bid as the "base" solution, unless noted otherwise. The Contractor may submit (as a proposed "alternate" solution) substitute manufacturers and models that may be more cost effective or readily available. All substitutions shall meet or exceed the minimum functional, physical, and technical specifications. Acceptance of such substitutions is at the discretion of the Architect, and Engineer. Additionally, the requirements of Division 1 Specifications shall apply and may supersede requirements noted herein.

C. Prefabrication Shop Drawings
1. Symbol Legend, Abbreviations, and Description: Provide drawings including descriptions of all abbreviations, symbols, typical mounting heights, project information, etc.
2. One-Line Wiring Diagrams: Include one-line wiring diagrams indicating all backbone and horizontal cabling, copper pair and fiber strand counts, cable quantities, splice enclosures, etc.
3. Site Plan: Provide complete site and exterior plans indicating all site and building façade mounted communication device outlets, equipment, and components proposed to be installed. Additionally, manholes, pull-boxes, and all major raceway routing shall be indicated for conduits 2-inches and larger. Shop drawings shall represent final conduit routing and manhole and/or pull-box placement as coordinated and/or confirmed with Service Provider, Civil Engineer and other trades.
4. Floor Plans: Indicating all communication device outlets, equipment, and components proposed to be installed. Floor plans shall indicate cable routing origin and labeling scheme for each cable and termination position. Additionally, major raceway routing shall be indicated for cable trays and conduits 2-inches and larger, based on final coordination with all other trades. Shop shall clearly indicate areas with cable tray clearance limitations and/or other cable access limitations for review and approval by the Architect, and Engineer.
5. Enlarged Plans: Provide ¼" = 1'-0" enlarged plans of all communication rooms including Telecommunications Entrance Facilities (TEF), Telecommunications Rooms (TR), and Equipment Rooms (ER), indicating the position of equipment cabinets, racks, wiring terminals, patch panels, grounding equipment, cable tray, fiber and copper terminations, and other low voltage systems equipment layout within the rooms. Additionally, shop drawings shall clearly indicate final conduit/riser (core drill and/or block-out) locations and sizes as coordinated and/or confirmed with Structural Engineer and any field conditions that impact proposed location. Shop drawings shall clearly indicate areas where equipment clearances may be limited, for review and approval by the Architect.
6. Details: Including method of attachment of racks to the floor and ladder tray systems, method of attachment of wall mounted distribution frames, grounding details indicating grounding method for cabinets, racks, cable tray, cable management, and power details for rack mounted power distribution.
7. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including electrical receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing enclosures, termination equipment, supporting electrical and mechanical infrastructure equipment, and cable paths. Include following rooms:
    a. Telecommunications Rooms (TRs) and Antenna Headend Rooms.
    b. Entrance Rooms.10.
    c. Computer Room.

8. Cable Plant Distribution Plans: Provide facility and campus plan drawings showing inside plant and outside plant diverse path distribution pathways, distances, media types, and equipment.
9. Computer Room Structured Cabling Plans: Provide logical, schematic, or plan drawings of the structured cabling system in the facility computer room showing diverse path distribution pathways, distances, media types, and equipment.
    a. Logical Drawings: Provide logical riser or schematic drawings for cable plant and grounding/bonding systems. Show termination points and identify wiring connections.
10. 10.IT Equipment Enclosure Elevation Drawings: Provide elevation drawings of racks and cabinets in all telecommunications spaces showing passive equipment layouts, grounding and bonding details, and power distribution equipment details.
11. 11.Provide parts list including quantity of spare parts.
    a. Provide manufacturer product information. Government reserves the right to request a list of installations where products have been in operation.
12. 12.Elevations:
    a. Rack elevations indicating patch panels, fiber terminals and enclosures, vertical and horizontal cable managers, rack mounted power strips or distribution units, etc.
    b. Wall elevations of distribution frame with block size, cable routing, cable management, pair counts, method of attachment, etc.
13. Drawing Scale: Shop drawings shall be drawn to scale and completely dimensioned as to clearly show construction detail.
14. Labeling: Provide documentation of all labeling schemes for conduit, back-boxes, cables, outlets, wiring blocks and/or patch
15. Documentation: Provide a minimum of (1) hardcopy set of prints (in addition to electronic copies) for review or as indicated in Division-1 general conditions.

D. Provide following closeout submittals prior to project closeout date:
1. Warranty certificates.(Both OEM Extended Warranty and Contractors Construction Warranty.)
2. Evidence of compliance with requirements such as low voltage certificate of inspection.
3. Project record documents.
4. Instruction manuals and software that are a part of system.

E. Maintenance and Operation Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
1. Prepare a manual for each system and equipment specified.
2. Furnish on portable storage drive in PDF format or equivalent accepted by Architect.
3. Furnish complete manual as specified in specification section, fifteen days prior to performance of systems or equipment test.
4. Furnish remaining manuals prior to final completion.
5. Identify storage drive "MAINTENANCE AND OPERATION MANUAL" and system name.
6. Include name, contact information and emergency service numbers of each subcontractor installing system or equipment and local representatives for system or equipment.
7. Provide a Table of Contents and assemble files to conform to Table of Contents.
8. Operation and Maintenance Data includes:
    a. Approved shop drawing for each item of equipment.
    b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
    c. A control sequence describing start-up, operation, and shutdown.
    d. Description of function of each principal item of equipment.
    e. Installation and maintenance instructions.
    f. Safety precautions.
    g. Diagrams and illustrations.
    h. Test Results and testing methods.
        1) Test results shall be formatted in the following fashion.

(a) Fiber Optic Cabling testing shall start at strand one of a specific fiber optic cable and shall end with the last strand on the same fiber optic cable. Test results of multiple fiber optic cables shall not be intermingled with each other. Testing shall proceed from the Port 1 of the fiber optic patch panel/LIU/FDU in a rack/cabinet and proceed sequentially to the last port before moving to the next patch panel/LIU/FDU or rack/cabinet.
(1) Multimode OLTS (Tier 1)
(2) Multimode OTDR (Tier 2)
(3) Singlemode OLTS (Tier 1)
(4) Singlemode OTDR (Tier 2)
(b) Category 6A Cabling shall start at the first port of the first patch panel in the first rack/cabinet in the MCR/TR and proceed sequentially to the last patch panel in the last rack/cabinet.

2) Testing Methods
(a) Fiber Optic Cable
(1) Test equipment shall be set to test the specific manufacturers part number of the cable being tested, not to generic/general fiber optic cable settings.
(2) Macrobend detection shall be enabled
(b) Category 6A Cable
(1) Test equipment shall be set to test the specific manufacturers part number of the cable being tested, not to generic/general cable settings.
(2) Marginal pass results are not acceptable, a full pass must be recorded for each cable.

i. Performance data.
j. Pictorial "exploded" parts list with part numbers. Emphasis to be placed on use of special tools and instruments. Indicate sources of supply, recommended spare parts, and name of servicing organization.
k. Warranty documentation indicating end date and equipment protected under warranty.
l. Appendix; list qualified permanent servicing organizations for support of equipment, including addresses and certified personnel qualifications.

F. Record Wiring Diagrams:
1. Red Line Drawings: Keep one E size (36 inches x 48 inches) set of floor plans, on site during work hours, showing installation progress marked and backbone cable labels noted. Make these drawings available for examination during construction meetings or field inspections.
2. General Drawing Specifications: Detail and elevation drawings to be D size (24 inches x 36 inches) with a minimum scale of (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size (24” x 36”) with a minimum scale of (1/4 inch = 12 inches). Building composite floor plan drawings to be D size (24 inches x 36 inches) with a minimum scale of (1/8 inch = 1’ 0 inch).
3. Building Composite Floor Plans: Provide building floor plans showing work area outlet locations and configuration, types of jacks, distance for each cable, and cable routing locations.
4. Floor plans to include:
a. Final room numbers and actual backbone cabling and pathway locations and labeling.
b. Inputs and outputs of equipment identified according to labels installed on cables and equipment
c. Device locations with labels.
d. Conduit.

e. Listed/rated assemblies and sleeve penetrations through fire rated walls.(Include sizes and counts)
f. Vertical Riser penetrations through floors. (Include sizes and counts)
g. Head-end equipment.
h. Wiring diagram.
i. Labeling and administration documentation.

5. Submit Record Wiring Diagrams within five business days after final cable testing.
6. Deliver Record Wiring Diagrams as CAD files in .dwg or.rvt formats as determined by Architect.
7. Deliver four complete sets of electronic record wiring diagrams to Architect on portable storage drive.

G. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within four hours of receipt of notification service is needed.

1.05 QUALITY ASSURANCE

A. Codes and Standards: All materials and installations shall comply with current applicable codes and standards, including but not limited to:
1. VA Infrastructure Standard for Telecommunications Spaces (ISTS)
ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
2. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
3. ANSI/EIA/TIA-568-C.0: Generic Communications Cabling for Customer Premises.
4. ANSI/EIA/TIA-568-C.1: Commercial Building Communications Cabling Standards, Part 1: General Requirements.
5. ANSI/EIA/TIA-568-C.2: Balanced Twisted-Pair Communications Cabling and Components Standard.
6. ANSI/EIA/TIA-568-C.3: Optical Fiber Cabling Components Standard.
7. ANSI/EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
8. ANSI/J-STD-607-A: Commercial Building Grounding and Bonding Requirements for Communications.
9. TIA-758-A: Customer-Owned Outside Plant Communications Cabling Standard.
10. ANSI/TIA-942: Telecommunications Infrastructure Standard for Data Centers.
11. ANSI/TIA-1179-B: Healthcare Facility Telecommunications Infrastructure Standard
12. ASTM: American Society for Testing and Materials
13. BICSI CO-OSP Design Manual (current edition): Customer-Owned Outside-Plant Design Manual
14. BICSI Electronic Safety and Security (ESS) Design Reference Manual (current edition).
14. BICSI Network Design Reference Manual (current edition).
15. BICSI TDM Telecommunications Distribution Methods Manual (current edition).
16. BICSI Wireless Design Reference Manual (current).
17. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.
18. ICEA: Insulated Cable Engineers Association
19. IEEE 802.11 a, g, n, a/c: Wireless Local Area Networks.
20. IEEE 802.3: 10 Mb/s, 100 Mb/s, 1 Gb/s, and 10 Gb/s Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)
21. IEEE-802.3ak: 10 Gb/s Ethernet (evolving copper standard).
22. IEEE 1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
23. IEEE 141: Recommended Practice
24. IEEE 241: Recommended Practice for Electric Power Systems in Commercial Buildings
25. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises. 27. NESC: National Electrical Safety Code

26. EMA Stds Pub No. VE 1, Cable Tray Systems. Additionally, comply with current edition of NEC, as applicable to construction and installation of cable tray systems.
27. NEMA Std 250: Enclosures for Electrical Equipment (1000 Volts Maximum). 30. NFPA 70/NEC: National Electrical Code.
28. NFPA 72: National Fire Alarm and Signaling Code 32. UL Compliance: Provide products which are UL-listed and labeled.
29. USDA Bulletin 1751F-643: Underground Plant Design.

B. Manufacturer and Product Qualifications
   1. Provide products from manufacturers regularly engaged in the production of communications infrastructure components, including but not limited to, raceway, horizontal copper cabling, copper and fiber optic backbone cabling, and connecting hardware.
   2. Provide products from manufacturers whose products of similar types, capacities, and characteristics have been in satisfactory use in similar type projects for not less than five years.
   3. Quality assurance requirements apply to equipment and systems described in the ISTS
   4. Manufacturer’s Qualifications: Manufacturer must produce, as a principal product, the equipment and material specified for this project and have manufactured item for at least three years.
   5. Product and System Qualification:
      a. OEM must have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
      b. Government reserves the right to request a list of installations where products have been in operation before approval.
      c. Authorized representative of OEM must be responsible for design, satisfactory operation of installed system, and certification.
   6. Comply with FAR clause 52.236-5 for material and workmanship.
   7. When more than one unit of same class of equipment is required, units must be product of a single manufacturer.
   8. Equipment Assemblies and Components:
      a. Components of an assembled unit need not be products of same manufacturer.
      b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
      c. Provide compatible components for assembly and intended service.
      d. Constituent parts which are similar must be product of a single manufacturer.
   9. Identify factory wiring on equipment being furnished and on wiring diagrams.
   10. Testing Agencies: Government reserves the option of witnessing
   11. factory tests. Notify Architect minimum 15 working days
   12. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

C. Contractor Qualifications
   1. The company shall have a fully staffed office with technical installations support personnel within the metropolitan area. (Exceptions to this shall be confirmed through approval by the Architect, and Engineer.)
   2. The Low Voltage Raceway Contractor shall be a certified installer (current and in good standing with proven history) of the selected manufacturer’s raceway systems and shall provide a 25-year warranty on installation and applications.

D. All materials shall be Underwriters Laboratories (UL) or Intertek Testing Services (ETL) Listed unless otherwise indicated.

E. Coordinate with electrical work and other trades to properly interface installation of communications raceway.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.

B. Store equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.

C. Handle equipment and components carefully to prevent damage. Do not install damaged units or components; replace them with new.

D. Delivery and Acceptance Requirements:
   1. Government's approval of submittals must be obtained for equipment and material before delivery to job site.
   2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for Architect to inventory equipment

E. Storage and Handling Requirements
   Equipment and materials must be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
   1. Store and protect equipment in a manner that precludes damage or loss, including theft.
   2. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent
   3. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.

F. Coordinate storage.

1.07 SEQUENCING AND SCHEDULING

A. Contractor shall be proactive in scheduling work:
   1. Use of premises is restricted at times directed by Architect.
   2. Movement of materials: Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.
   3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Plan for large equipment requiring positioning prior to closing in building.
   5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
   6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule

B. All work shall be reviewed and coordinated with the Architect and OIT Data Center & Infrastructure Engineering (DCIE) prior to commencing.

C. Communication systems, infrastructure, raceway and equipment are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The contractor shall ensure the storage and installation of all communication components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems. All mis-installed components shall be replaced with new parts and re-installed at the Contractor’s expense.

D. Coordinate installation with Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.

E. Sequence installation of communications systems and infrastructure with other work to minimize possibility of damage and soiling during remainder of construction.

1.08 PROJECT SITE CONDITIONS

A. Prior to submitting a proposal, the Contractor shall inspect the Contract Documents, and shall become fully informed as to laws, ordinances, VA construction documents, and regulations affecting the project. The Contractor shall immediately bring to Architect's attention, in writing, any existing condition or statute that contradicts, is in conflict with, or negates the Contract Documents. Failure of the Contractor to become fully informed as to all above mentioned items shall in no way relieve the Contractor from any obligations with respect to their proposal.

B. The Technology Drawings depict equipment locations, backboxes, conduit runs, cabling, etc. in a schematic manner. Field conditions and coordination with related trades may warrant relocations of field devices. No additional compensation will be allowed due to these revisions.

1.09 WARRANTY

A. A one (1) year warranty on the work shall be provided by the Contractor. If, within one (1) year after the date of final acceptance of the installation or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents or provided by a manufacturer, any of the work or equipment is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly including all parts and labor after receipt of notice from the Architect to do so unless the Architect has previously given the Contractor a written acceptance of such condition. This obligation shall survive termination of the contract. The Architect shall give such notice promptly after discovery of the condition.

B. Nothing contained in the Contract Documents shall be construed to establish a shorter period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents or any manufacturer's warranty. The establishment of the time period noted above, after the date of final acceptance or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents, relates only to the specific obligation of the Contractor to correct the work or equipment, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations other than specifically to correct the work or equipment.

C. The agency reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided that the expansion is done by a firm which is an authorized dealer or agent for the equipment of system being expanded.

1.10 SPECIFICATION RESPONSE

A. Pricing

Instructions to Bidders

1. The following is a partial list of instructions. Bidders are responsible to provide a complete proposal inclusive of all information requested in the Contract Documents.
2. Do not assume anything. Clarify your position in writing with your bid concerning any areas that may not be clear to you.
3. Copies of the bid proposal shall be submitted to the Architect, and Engineer for review and approval.
4. Bidders shall prepare equipment lists showing each item included in the bid. Equipment Lists must include the quantity, model number, manufacturer and price of each item listed under the generic description.
5. Provide a detailed description of any and all voluntary alternates and include cost changes in the Voluntary Alternate Bid forms. Bidders should submit voluntary alternates that will either provide for a better system or reduce costs without degrading the system. This includes alternate manufacturer and product substitution.

6. In the instance where the Drawings and the Specifications do not directly coincide, or coincide individually, the item of better quality, greater quantity and/or higher cost shall be included in the base bid.

B. Compliance

Bidders shall submit a Statement of Qualifications with their bid proposal that shall include the following information:

1. Company name, address, telephone number and contact person.
2. Brief company history. c. Resumes of key personnel.
3. Local staffing description (job descriptions and numbers of persons in each position).
4. Local service capabilities (hours of operation and parts availability). f. Technician factory certifications.
5. Description of local engineering and project management capabilities.
6. Line sheet listing major suppliers of security equipment.
7. Annual dollar value of sales, installation and service of each product line carried.
8. List of references describing three (3) completed projects of similar size and complexity, including names and telephone numbers of the contact persons.
9. List of references describing similar projects completed in the area including names and telephone number of the customer's contact person.
10. List of similar projects currently under construction in the area including names and telephone numbers of the customer's contact person.
11. Licensing information.

C. Provide a specification compliance matrix indicating compliance or deviation for each item in the specification. The matrix shall be comprised of a list of all numbered paragraphs that appear in this Specification. Indicate compliance of the proposed equipment and/or services by the word "Comply" following each paragraph number. Indicate an exception to the requirement by the word "Exception" following the applicable paragraph number. Should the proposed equipment and/or services not entirely comply with the requirements specified, but ultimately achieve the intent, the Bidder shall explain fully the extent, or lack thereof, of compliance for the applicable equipment and/or services proposed. Instances where there is no indication of compliance or exception shall be considered non-compliant. This matrix is critical for proposal evaluation. Failure to submit may result in the disqualification of the bid. Contractor shall submit Compliance Matrix with the Bid Proposal AND at the time of Product Data submittal (as indicated previously in this specification) so that a complete security system submittal reviewed can be performed.

D. Additionally, as described in this Specification, bidders shall submit the following information with their bid proposal:

1. Manufacturer's literature sheets for all standard manufactured items included in the equipment list and as proposed in the Voluntary Alternate Bid form, if applicable.
2. Workload and capability statements. The statements shall detail projects that will be active during the completion of this project, and the manpower that would be available for this project.
3. Confidentiality and return statements. The statements shall guarantee that the Contract Documents shall not be copied or distributed physically or verbally. The Contractor shall also assure the Architect that the Contract Documents shall be returned in their entirety upon request. The successful Contractor will be provided with as many copies as requested.
4. Copy of manufacturer’s certification certificate.

E. Certain paragraphs of the Specification require the Bidder to provide information (possibly not listed above) in the proposal to demonstrate compliance with a requirement. If the Bidder fails to provide detailed responses to these items, the proposal will be deemed to be non-compliant to the paragraphs stated.

F. Number all pages of the bid submittal.

PART 2 – PRODUCTS

2.01 REFER TO THE FOLLOWING SPECIFICATIONSECTIONS FOR ADDITIONAL REQUIREMENTS:

A. 27 05 26 – GROUNDING AND BONDING FOR TELECOMMUNICATIONS SYSTEMS
B. 227 05 33 - RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS
C. 27 05 36 – CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
D. 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
E. 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS
F. 27 10 00 - CONTROL + COMMUNICATIONS AND SIGNAL WIRING
G. 27 11 16 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
H. 27 11 19 - COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
I. 27 11 26 - COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
J. 27 13 13 - COMMUNICATIONS COPPER BACKBONE CABLING
K. 27 13 13.13 - COMMUNICATIONS COPPER CABLE SPLICING AND TERMINATIONS
L. 27 13 23 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING
M. 27 13 23.13 - COMMUNICATIONS OPTICAL FIBER CABLE SPLICING AND TERMINATIONS
N. 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING
O. 27 16 19 - COMMUNIICATIONS PATCH CORDS, STATION CORDS AND CROSS CONNECT WIRE

PART 3 – EXECUTIOTN

3.01 GENERAL COMMUNICATION RACEWAYS:

A. Examine areas and conditions under which communications raceway systems are to be installed. Notify the Architect, and Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
B. The Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
C. The Contractor shall be responsible for furnishing all materials indicated on the drawings or as specified herein for a complete communications raceway system
D. All communications raceway infrastructure shall be installed in an aesthetically pleasing fashion. All surface raceway in new buildings must be approved by the Architect, and/or Engineer.
E. All communications raceway infrastructure shall be installed to allow for easy adds, moves, and other changes in the future.
F. Construction within communication rooms must be substantially complete before the installation of telecommunications cabling. This includes, but is not limited to, the installation of plywood backboard, cable tray or ladder rack, electrical outlets, light fixtures, sprinklers and ductwork.
G. Floor-to-floor distribution shall be provided with concrete floor sleeves or conduits as noted on the drawings, and as required by the Architecoctural Design.
H. Provide protective cable bushings on all conduits immediately after installation
I. Use only electrical 45º or 90º conduit elbows with long bend radii as follows:
    1. 1.6:1 bend radius of the inside conduit diameter for sizes 2” or less.
    2. 10:1 bend radius of the inside conduit diameter for sizes greater than 2”.

J. Fire seal all raceway penetrations and openings to maintain fire rating after communications cables are installed.

K. Furnish electronic certified test reports to Architect prior to final inspection and not more than 90 days after completion of tests.

3.02 LABELING

A. All communications components shall be clearly labeled using labeling devices (i.e. handwritten labels are not acceptable) with white label and black text. All labels shall be consistent font type and size (for respective components). All labeling shall comply with the current version of ISTS /or EIA/TIA-606.

B. The final labeling scheme shall be coordinated with the Architect and Infrastructure Engineering prior to finalizing and initiating any work. A sample scheme shall be submitted for approval.

END OF SECTION

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies grounding and bonding requirements of communications installations based on the requirements of ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises. Work covered by this Section shall consist of furnishing supplies, labor, materials, equipment, labeling, and tools. Testing is required unless otherwise specified. An operable grounding and bonding infrastructure is required as described on the Drawings and/or required by these specifications. All materials shall be listed by a nationally recognized testing laboratory (NRTL).

1.02 SUMMARY

SECTION INCLUDES:

A. Required Bonding Busbars.

B. Supplemental Bonding Networks.

C. Telecommunications Bonding Conductors.

D. Joining Requirements.

E. Overvoltage Surge Protectors.

1.03 REFERENCES

A. ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

B. NFPA 70, National Electrical Code (NEC).

C. International Annealed Copper Standard (IACS).

D. BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

E. UL 497 & UL 497A, UL Standards for Primary & Secondary Safety Protectors for Paired-Conductor Communications Circuits.

1.04 RELATED WORK

A. Facility grounding and bonding requirements: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

B. Information Technology equipment enclosures: Section 27 11 16, COMMUNICATION CABINETS, RACKS, FRAMES, AND ENCLOSURES.

1.05 SUBMITTALS

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

B. Provide riser diagram indicating location of communications grounding system connections indicating routing of grounding conductors.

C. Closeout Submittals: Provide test reports of ground resistance to each primary or secondary bonding busbar (PBB/SBB) located in each telecommunications space impacted by the work.

PART 2 PRODUCTS

2.01 BONDING BUSBARS.

Bonding busbars are located in each telecommunications space and in each network rack/cabinet. Bonding busbars provide common locations in the telecommunications space for the connection of the telecommunications bonding conductors.

A. Common Requirements.

1. Provided with holes for use with correctly-matched UL Listed two-hole lugs and hardware.
2. Constructed of copper or copper alloy with a minimum of 95% conductivity when annealed.
3. Annealed as specified by the International Annealed Copper Standard (IACS).
4. Installation resulting in a maximum 4.0Ω to ground resistance measured from any point in the system.
5. Installation is insulated from the mounting surface through the use of appropriate insulators.
6. UL Listed.

B. Primary Bonding Busbar (PBB). The PBB is a dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The PBB also serves as the central attachment point for Secondary Bonding Busbars (SBB) via Telecommunications Bonding Backbone (TBB).
1. Pre-drilled copper with holes to accommodate lug mounting holes.
2. Sized for current applications and future growth.
3. Insulated from its supports.
4. Electro-tin plated is acceptable.
5. Maintain a 2” min clearance between busbar and finished wall.
6. Size must be 0.25” thick by 4” wide by 20” length.

C. Secondary Bonding Busbar (SBB). The SBB is a common point of connection for telecommunications system and equipment bonding to a ground located in each Telecommunications Room.
1. Pre-drilled holes to accommodate dual-lug mounting holes.
2. 0.25” thick x 2” wide with varying length to be sized for current applications and future growth.
3. Maintain a 2” min clearance between the finished wall and busbar.
4. Copper or tin annealed copper.

D. Rack Bonding Busbar (RBB). The RBB is a busbar located in a cabinet, rack, or frame.
1. Mounting. Horizontal mounting to an EIA-310-D 19” equipment rack is specified.
2. Capacity: 10 Double-hole lugs.
3. Size & material 0.75” wide x 19” length x 0.25” thick – Copper or tin annealed copper.

2.02 SUPPLEMENTAL BONDING NETWORKS.

Also known as Signal Reference Grids (SRGs), Mesh Bonding Networks (Mesh-BN), or Isolated Bonding Networks (IBNs), the requirements for supplemental bonding networks are not specified in this document. Supplemental bonding networks may not be used to replace a standards-compliant bonding infrastructure.

1. TELECOMMUNICATIONS BONDING BACKBONE (TBB).
   The TBB bonds the facility Primary Bonding Busbar (PBB) to telecommunications space Secondary Bonding Busbars (SBBs).
   a. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.
   b. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D and will be as straight as practicable avoiding bends.
   c. Bonding the TBB to the PBB and each SBB will require a UL Listed irreversible compression (crimp) dual-lug connector.
2. BONDING CONDUCTORS.
   a. Telecommunications Equipment Bonding Conductor (TEBC). The TEBC connects the cabinets and racks in the telecommunications space to the space’s bonding busbar (PBB or SBB).
3. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.

4. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D. The minimum size for the TEBC shall be AWG 6.
5. Bonding. Bonded to the telecommunications space bonding busbar (PBB or SBB) via a UL Listed two-hole compression lug. Rack Bonding Conductors (RBCs) are connected to the TEBC using UL Listed irreversible compression (crimp) connectors.
    a. Rack Bonding Conductor (RBC). The RBC is a bonding conductor from the cabinet or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
6. Material. Stranded copper wire with a green jacket run as a continuous conductor.
7. Size. The minimum size for the RBC shall be AWG 6.
8. Bonding. Bonded to the Telecommunications Equipment Bonding Conductor (TEBC) using UL Listed irreversible compression (crimp) connectors.
    a. Where connected to a server cabinet, the RBC extends to the bottom of the server cabinet allowing Equipment Bonding Conductors to be attached at any point in the cabinet.
    b. Where connected to a network rack/cabinet, the Rack Bonding Conductor (RBC) is bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug.
    c. Equipment/Unit Bonding Conductor (EBC/UBC). The Equipment/Unit Bonding Conductor connects individual equipment in a cabinet or rack to the Rack Bonding Conductor (RBC) or Rack Bonding Busbar (RBB). Equipment Bonding conductors are also used as cable tray bonding conductors to bond cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC).
9. Material. Stranded copper wire with a green jacket run as a continuous conductor.
10. Size. The minimum size for the RBC shall be AWG 6.
11. Bonding.
    a. Where used in a server cabinet, bonded to the Rack Bonding Connector (RBC) using UL Listed irreversible compression (crimp) connectors and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)
    b. Where used in a network cabinet/rack, bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)
    c. Where used as a cable tray bonding conductor connecting cable tray sections, bonded to each adjoining section of the cable tray using UL Listed two-hole compression lugs.
    d. Where used as a cable tray bonding conductor connecting cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC), bonded to the TEBC using UL Listed irreversible compression (crimp) connectors and to the cable tray via a UL Listed two-hole compression lug.
12. Contractor shall furnish a minimum of ten (10) EBCs for each RBB. Five (5) EBCs shall be outfitted as described here and shall be six (6) feet in length. Five (5) EBCs shall be outfitted as decried here and shall be nine (9) feet in length. Contractor shall use field measurements to determine EBC cable length when directed by project managers.
13. OVERVOLTAGE SURGE PROTECTORS.
    a. Protectors are voltage-limiting devices intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents in communications lines caused by lightning, contacts with power conductors, power induction, and rises in ground potential.
14. Compliance. Protectors shall be compliant with UL 497 and/or UL 497A, as applicable.
15. Performance. Protectors shall be rated to support copper UTP performance Category 5e at 100MHz.
16. Protection. Voltage suppression shall be via low capacitance solid state protectors only, rated at 18V for copper backbone applications or 65V for VOIP or PoE applications.
17. Construction. Provide protection for each pair.
18. Termination shall be insulation-displacement contact.

19. Mounting. Protectors shall be wall-mounted.

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. Components of the telecommunications bonding system will be installed and connected using materials and techniques required by ANSI/TIA-607-D. The use of antioxidant joint compound is required for all connections excluding protector 110 block connections.

B. Testing.
   1. Perform tests per BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.
   2. Perform two-point bond test using trained installers qualified to use test equipment.
   3. Conduct continuity tests to verify that metallic pathways in telecommunications spaces are bonded to PBB or SBB.
   4. Conduct electrical continuity test to verify that PBB is effectively bonded to the facility grounding electrode conductor.
   5. Perform resistance tests to ensure rack and cabinet bonding connection resistance measures less than 4Ω to PBB or SBB.

END OF SECTION

SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

THIS SECTION SPECIFIES LABELING AND IDENTIFICATION REQUIREMENTS FOR INFORMATION TECHNOLOGY (IT) EQUIPMENT CABINETS, RACKS, AND CABLING.

1.02 SUMMARY

Section Includes:

A. Equipment and component labels.

B. Labeling implementation requirements.

1.03 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. ANSI/TIA-606 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1.04 RELATED WORK:

A. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS

B. Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.

C. Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.

D. Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

E. Section 27 13 23.13, COMMUNICATIONS OPTICAL FIBER SPLICING AND TGERMINATIONS.

F. Section 27 10 00 STRUCTURED CABLING..

G. Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.

H. Section 27 13 13.13, COMMUNICATIONS COPPER SPLICING AND TGERMINATIONS.

1.05 SUBMITTALS:

SUBMIT IN ACCORDANCE WITH

A. Section 01 33 23, SHOP DRAWINGS PRODUCT DATA AND SAMPLES

B. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS

PART 2 - PRODUCTS

2.01 EQUIPMENT AND COMPONENT LABELS.

A. Materials. Materials used for labeling equipment, components, and telecommunications cabling shall be appropriate for the installation environment, durable and permanent, and heat-resistant if necessary for labeling in high-temperature environments.

B. The text on labels shall be machine generated. Hand printed labels are not acceptable.

C. Labels shall be black text on a white background, and self laminating.

PART 3 - EXECUTION

3.01 IMPLEMENTION:

A. Governing Standard. Labeling and identification of equipment, components, and telecommunications cabling shall be based on ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure, and NFPA 70, National Electrical Code.

B. All passive infrastructure equipment, components, and telecommunications cabling installed shall be labeled at the time of installation.

C. Telecommunications cable labeling shall include delivery of complete and accurate connection documentation (where each cable terminates at each end) matching the installed labels.

- - - E N D - - -

END OF SECTION

SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes requirements for commissioning facility communications systems, related subsystems and related equipment. This Section supplements general requirements specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

B. Complete list of equipment and systems to be commissioned is specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Specification 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Commissioned Systems:
   1. Commissioning of systems specified in Division 27 and 28 is part of project's construction process including documentation and proof of performance testing of these systems, as well as training of end users's Operation and Maintenance personnel in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Division 27, in cooperation with end user and Commissioning Agent.
   2. The facility exterior closure systems commissioning includes communications systems listed in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS and 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.02 RELATED WORK

A. System tests: Section 01 00 00, GENERAL REQUIREMENTS.

B. Commissioning process requires review of selected submittals that pertain to systems to be commissioned: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Construction phase commissioning process and procedures including roles and responsibilities of commissioning team members and user training: Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

1.03 COORDINATION

A. Commissioning Agent will provide a list of submittals that must be reviewed by Commissioning Agent simultaneously with engineering review; do not proceed with work of sections identified without engineering and Commissioning Agent's review completed.

B. Commissioning of communications systems require inspection of individual elements of communications system construction throughout construction period. Coordinate with Commissioning Agent in accordance with Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and commissioning plan to schedule communications systems inspections as required to support the commissioning process.

1.04 CLOSEOUT SUBMITTALS

A. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for pre-functional checklists, equipment startup reports, and other commissioning documents.

B. Pre-Functional Checklists:
   1. Complete pre-functional checklists provided by commissioning agent to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing.
   2. Submit completed checklists to end user and to Commissioning Agent. Commissioning Agent can spot check a sample of completed checklists. If Commissioning Agent determines that information provided on the checklist is not accurate, Commissioning Agent then returns the marked-up checklist to Contractor for correction and resubmission.
   3. If Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, Commissioning Agent can select a broader sample of checklists for review.

4. If Commissioning Agent determines that a significant number of broader sample of checklists is also inaccurate, all checklists for the type of equipment will be returned to Contractor for correction and resubmission.

C. Submit training agendas and trainer resumes in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Contractor's Tests:
   1. Scheduled tests required by other sections of Division 27 must be documented in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
   2. Incorporate all testing into project schedule. Provide minimum seven calendar days' notice of testing for Commissioning Agent to witness selected Contractor tests at sole discretion of Commissioning Agent.
   3. Complete tests prior to scheduling Systems Functional Performance Testing.

B. Systems Functional Performance Testing:
   1. Commissioning process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions.
   2. Commissioning Agent prepares detailed Systems Functional Performance Test procedures for review and acceptance by end user.
   3. Provide required labor, materials, and test equipment identified in test procedure to perform tests.
   4. Commissioning Agent must witness and document the testing.
      a. Provide test reports to Commissioning Agent. Commissioning Agent will sign test reports to verify tests were performed.

3.02 TRAINING

A. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning location, operation, and troubleshooting of installed systems.

- - - E N D - - -

END OF SECTION

SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.01 DESCRIPTION:

THIS SECTION SPECIFIES INFORMATION TECHNOLOGY (IT) EQUIPMENT ENCLOSURES FOR USE IN TELECOMMUNICATIONS SPACES.

1.02 SUMMARY

SECTION INCLUDES:

A. Server Cabinets.

B. Network Channel Racks.

C. Network Cabinets.

D. Telecommunications Enclosures.

E. Pathway Racks.

1.03 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. ANSI/TIA-568 COMMERCIAL BUILDING TELECOMMUNICATIONS CABLING STANNDARD SET

C. ANSI/TIA-569 TELECOMMUNICATIONS PATHWAYS AND SPACES

D. ANSI/TIA-606 ADMINISTRATIVE STANDARDS FOR TELECOMMUNICATIONS INFRASTRUCTURE

E. ANSI/TIA-607 TELECOMMUNICATIONS BONDING AND GROUNDING FOR CUSTOMER PREMISES

F. ANSI/TIA 1179 HEALTHCARE FACILITY TELECOMMUNICATIONS INFRASTRUCTURE STANDARD

G. BICSI Telecommunications Distribution Methods Manual (TDMM).

H. ICSI Information Technology Systems Installation Methods Manual (ITSIMM)

1.04 RELATED WORK:

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

B. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

C. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

D. Section 27 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.

E. Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEM

F. Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

G. Section 27 11 26, COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS.

H. Section 27 15 00, COMMUNICATIONS STRUCTURED CABLING

1.05 SUBMITTALS:

SUBMIT IN ACCORDANCE WITH

A. Section 01 33 23, SHOP DRAWINGS PRODUCT DATA AND SAMPLES

B. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS

PART 2 - PRODUCTS

2.01 SERVER CABINETS.

A. Height. Cabinets shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

B. Dimensions. Nominal dimensions for server cabinets are 84” tall, 23.6” wide, and 48” deep, including side panels and doors. Minimum depth is 46”. Maximum width is 24” 762 mm).

C. Doors and Panels.
   1. Front Door. Provide a single locking, latched, hinged metal front door for the server cabinet with minimum 75% open perforated design for airflow.
   2. Rear Door. Provide a locking, latched, hinged metal rear door for the server cabinet.
      a. If a vertical exhaust duct (VED, “chimney”) is specified for the server cabinet, the rear door shall be solid.
      b. If no VED is specified, the rear door shall be perforated with a minimum of 75% open design for airflow.
   3. Side Panels. Provide removable, locking solid metal side panels. Side panels shall have cable pass-through cut-outs protected with brushed grommets on each side, aligned on each side to allow Rack PDU cables to pass between enclosures to Zone PDUs.

D. Locks. All locks on a server cabinet shall be keyed the same. Provide two keys per cabinet.

E. Color. The cabinet and all components shall be white in color.

F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard 3/8” x 3/8” square hole mounting.

G. Rear Rails. Position rear rails with a minimum of 6” of clearance between the rails and the rear doors to accommodate rear-mounted angled patch panels and up to four (4) vertical rack PDUs.

H. Components. The cabinet shall be supplied with the following standard equipment:
   1. Air dams for left and right of the front rails.
   2. Finger cable managers.
   3. Bottom panel with brushed grommets.
   4. Top panel with brushed grommets.
   5. Toolless mounting brackets for vertical Rack PDUs.
   6. 45U of 1RU blanking panels.
   7. Vertical Exhaust Duct. Provide a vertical exhaust duct (VED, or “chimney”) matched to the height of the cabinet and facility horizontal return duct.

2.02 NETWORK CHANNEL RACKS.

A. Height. Racks shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

B. Dimensions. Nominal dimensions for network racks are 86” tall, 24” wide, and 40” deep (30” between front and rear mounting rails).

C. Side Panels. The rack shall have integral metal side panels (a “channel” rack) constructed with a cable management pattern of staggered shapes (circles, hexagons, etc.) to allow for connection points for cable management accessories.

D. Color. The rack and all components shall be white in color.

E. Equipment Mounting Rack. The rack shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard 3/8” x 3/8” square hole mounting.

F. Components. The rack shall be supplied with the following standard equipment:
   1. Toolless mounting brackets for vertical Rack PDUs.
   2. 30U of 1RU blanking panels.
   3. Vertical cable managers with doors on both left and right of the rack (size commensurate with the requirement).

4. Cable management accessories as necessary to maintain cable bend radii, uniformity, and neatness (e.g. d-rings, spools, bend radius limiters, finger cable managers, waterfalls, etc.).

2.03 NETWORK CABINETS

A. Height. Cabinets shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

B. Dimensions. Nominal dimensions for server cabinets are 84” tall, 31.5” 40” wide, and 48” deep, including side panels and doors. Minimum depth i. Maximum width is 24”.

C. Doors and Panels.
   1. Front Door. Provide a single locking, latched, hinged metal front door for the server cabinet with minimum 75% open perforated design for airflow.
   2. Rear Door. Provide a locking, latched, hinged metal rear door for the server cabinet.
      a. If a vertical exhaust duct (VED, “chimney”) is specified for the server cabinet, the rear door shall be solid.
      b. If no VED is specified, the rear door shall be perforated with a minimum of 75% open design for airflow.
   3. Side Panels. Provide removable, locking solid metal side panels. Side panels shall have cable pass-through cut-outs protected with brushed grommets on each side, aligned on each side to allow Rack PDU and communications cables to pass between enclosures to Zone PDUs.

D. Locks. All locks on a server cabinet shall be keyed the same. Provide two keys per cabinet.

E. Color. The cabinet and all components shall be white in color.

F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard 3/8” x 3/8” square hole mounting.

G. Components. The cabinet shall be supplied with the following standard equipment:
   1. Air dams for left and right of the front rails.
   2. Bottom panel with brushed grommets.
   3. Top panel with brushed grommets.
   4. Toolless mounting brackets for vertical Rack PDUs.
   5. 45U of 1RU blanking panels.
   6. Cable management accessories as necessary to maintain cable bend radii, uniformity, and neatness (e.g. d-rings, spools, bend radius limiters, finger cable managers, waterfalls, etc.).
   7. Vertical Exhaust Duct. Provide a vertical exhaust duct (VED, or “chimney”) matched to the height of the cabinet and facility horizontal return duct.

2.04 TELECOMMUNICATIONS ENCLOSURES (TE)

Telecommunications Enclosures (TEs) are swing-out wall-mounted enclosures.

A. Height. TEs shall provide 26 standard rack units (RU) of space for mounting equipment.

B. Doors and Panels.
   1. Front Door. TEs shall have a single locking, latched, hinged metal front door with a tempered glass front.
   2. Rear Panel. TEs shall have a latched, hinged metal rear door that mounts to the wall, allowing the body of the TE to be swung open for rear equipment access. If latched exterior to the body of the TE, the latch shall be locking.
   3. Cabling Cutouts. The top and bottom surfaces of the rear panel shall have cabling cutouts to accommodate telecommunications cabling entering the TE. Edge-protection grommets for the cabling cutouts shall be provided.
   4. Power Cutout. The rear panel shall have a cutout on the rear mounting surface allowing power to be installed internal to the TE.
   5. Locks. All locks on a TE shall be keyed the same. Provide two keys per TE.

6. Load Rating. The TE shall support 300lb of total weight.
7. Color. The cabinet and all components shall be white in color.
8. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard threaded #12-24 hole mounting.
9. Components. The cabinet shall be supplied with the following standard equipment:
    a. 1U shelf (two per TE).
    b. Vertical cable management kits (one per each full 12U of TE height).
    c. Fan kit to evacuate heat generated by active equipment (two per TE).
    d. Filter kit for fans (two per TE).

2.05 PATHWAY RACKS

A. Height. Pathway racks shall provide a minimum of 5 standard rack units (RU) of space (5U) for mounting Equipment Distributor equipment.

B. Dimensions. Nominal dimensions for pathway racks are 12.6” tall, 23.6” wide, and 9” deep.

C. Mounting. Pathway racks shall mount to standard basket-style cable tray.

D. Color. Pathway racks shall be white in color.

E. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with rails using standard 3/8” x 3/8” square hole mounting.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where to be installed in structures assigned to Seismic Design Category C, D, E, or F, seismic bracing equivalent to that for other storage racks per VA Master Specification 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS section 3.7 (“Install… to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements”) is required.

B. Casters on floor-mounted enclosures shall be retracted and the enclosures leveled and stabilized.

- - - E N D - - -

END OF SECTION

SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.01 DESCRIPTION:

THIS SECTION SPECIFIES CABLE TERMINATION AND MANAGEMENT EQUIPMENT TO BE MOUNTED IN INFORMATION TECHNOLOGY (IT) EQUIPMENT CABINETS AND RACKS.

1.02 SUMMARY

SECTION INCLUDES:

A. Copper UTP Patch Panels.

B. Fiber Optic Distribution Cabinets.

C. Fiber Optic Distribution Cassettes.

D. Fiber Optic Splice Cassettes.

E. Horizontal Cable Managers.

F. Blanking Panels.

REFERENCES

A. ANSI/TIA-598 OPTICAL FIBER COLOR CODING

B. ANSI/TIA-606 ADMINISTRATIVE STANDARDS FOR TELECOMMUNICATIONS INFRASTRUCTURE

C. ANSI/TIA-607 TELECOMMUNICATIONS BONDING AND GROUNDING FOR CUSTOMER PREMISES

D. ANSI/TIA 1179 HEALTHCARE FACILITY TELECOMMUNICATIONS INFRASTRUCTURE STANDARD

E. BICSI Telecommunications Distribution Methods Manual (TDMM).

F. BICSI Information Technology Systems Installation Methods Manual (ITSIMM)

1.03 RELATED WORK:

A. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

B. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

C. Section 27 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.

D. Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

E. Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

F. Section 27 13 23.13, COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS.

G. Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.

H. Section 27 15 00, COMMUNICATIONS STRUCTURED CABLING

1.04 SUBMITTALS:

A. Submit in accordance with

B. Section 01 33 23, SHOP DRAWINGS PRODUCT DATA AND SAMPLES.

C. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

PART 2 - PRODUCTS

2.01 COPPER (UTP) PATCH PANELS.

A. Form Factor.

1. Server Cabinets and Network/Channel Racks: 1U, 48 port, high density, 19” rack-mountable. Default form factor for patch panels shall be angled to extend not less than 4” (104mm) forward from the mounting rail.

2. Telecommunications Enclosures: 1U,48 port, high density, 19” rack-mountable. Default form factor for patch panels shall be flat.

B. Capacity. 48 copper 8P8C ports in groupings of 6.

C. Interface. Copper (UTP) patch panels shall accept pre-terminated single 8P8C keystone jacks and 6-jack cassettes.

D. Accessories. Provide each patch panel installation with the following accessories.
1. Server Cabinets and Network/Channel Racks: 1U, Angled panel cover. Specify angled panel covers at the top and bottom of each stack of angled patch panels. Covers shall mount to the same RU rail positions as the top and bottom patch panels.
2. Telecommunications Enclosures: 1U,flat blanking panel.
3. Rear cable manager tray. Specify one rear cable manager tray per patch panel. Trays shall mount to the same RU rail positions as the patch panel.

2.02 FIBER OPTIC DISTRIBUTION CABINETS.

A. Form Factor. 1U, 19” rack-mountable, angled to extend not less than 4” (104mm) forward from the mounting rail.

B. Capacity. 144 fibers in a variety of distribution and/or splice cassettes.

C. Door. Cabinets shall be supplied with a locking front cover.

D. Accessories. Provide each distribution cabinet with the following accessories.
1. Rear cable manager. Specify one rear cable manager with fiber storage rings per distribution cabinet. Trays shall mount to the same RU rail positions as the distribution cabinet.
2. 2RU patch cord managers. Specify one pair of patch cord managers per distribution cabinet. Managers shall mount to the same RU rail positions as the distribution cabinet and rear cable manager.

2.03 FIBER OPTIC DISTRIBUTION CASSETTES.

A. Fiber optic distribution cassettes are used in structured cabling in the computer room to connect Main Distribution Areas (MDAs), Horizontal Distribution Areas (HDAs), and Equipment Distributors (EDs) where pre-terminated cable is used.

B. Form Factor. Designed to install in rack-mounted fiber optic distribution cabinet.

C. Connections. The rear connection shall accept 12-strand multi-fiber push-on (MPO) connectors. Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber pairs 3 sets of 8-strand multi-fiber push-on (MPO) connectors or other (per specific design).

D. Polarity. Provide type universal polarity cassettes.

2.04 FIBER OPTIC SPLICE CASSETTES.

A. Fiber optic splice cassettes are used in backbone structured cabling connecting the Entrance Rooms to the Main Distribution Areas (MDAs) in the computer room, and the MDAs to Telecommunications Rooms (TRs) where field-terminated (fusion spliced) cable is used.

B. Form Factor. Designed to install in rack-mounted fiber optic distribution cabinet.

C. Connections. Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber pairs3 sets of 8-strand multi-fiber push-on (MPO) connectors or other (per specific design).

D. Design. Splice cassette modules shall be self-contained to integrate fiber adapter bulkhead and splice holders. No additional splice trays shall be necessary. Each module shall provide 24 fiber splice connections.

E. Fiber Type. Provide multimode OM4 and single-mode OS2 splice cassettes as required by the quantity of each type of fiber installed.

2.05 BLANKING PANELS.

A. Form Factor. 1U, 19” rack-mountable.

B. Transition. Blanking panel shall have a transition cover from angled front to flat front.

C. Quantity. Provide blanking panels to fill 75% of all RUs in all server cabinets and network cabinets.

PART 3 - EXECUTION

3.01 INSTALLATION:

NOT USED.

- - - E N D - - -

END OF SECTION

SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION

This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.

A. Furnish and install fully functional electronic safety and security cabling system(s), equipment and approved accessories in accordance with the specification section(s), drawing(s), and referenced publications. Capacities and ratings of cable and other items and arrangements for the specified items are shown on each system's required Bill of Materials (BOM) and verified on the approved system drawing(s). If there is a conflict between contract's specification(s) and drawings(s), the contract's specification requirements shall prevail.

B. The Contractor shall provide a fully functional and operating ESS, programmed, configured, documented, and tested as required herein and the respective Safety and Security System Specification(s). The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.

C. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include but not limited to: physical access control, intrusion detection, duress alarms, elevator control interface, video assessment and surveillance, video recording and storage, delayed egress, personal protection system, intercommunication system, fire alarm interface, equipment cabinetry, dedicated photo badging system and associated live camera, report printer, photo badge printer, and uninterruptible power supplies (UPS) interface. Operator training shall not be required as part of the Security Contractors scope and shall be provided by the Owner. The Security Contractor shall still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the procurement and installation of electrical wire and cables, the installation and testing of all system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and workmanship, shall be as specified herein. The Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits.

D. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under "Emergency Service". The Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. The Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall provide 24-hour telephone support for the software program at no additional charge to the owner. Software support shall include all software updates that occur during the warranty period.

E. Section Includes:
   1. Description of Work for Electronic Security Systems,
   2. Electronic security equipment coordination with relating Divisions,
   3. Submittal Requirements for Electronic Security,
   4. Miscellaneous Supporting equipment and materials for Electronic Security,
   5. Electronic security installation requirements.

1.02 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
C. Section 08 11 73 - SLIDING METAL FIRE DOORS. Requirements for door installation.
D. Section 08 35 13.13 - ACCORDIAN FOLDING DOORS. Requirements for door installation.
E. Section 08 34 59 - VAULT DOORS AND DAY GATES. Requirements for door and gate installation.
F. Section 08 51 13 - ALUMINUM WINDOWS. Requirements for window installation.
G. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.
H. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
I. Section 14 21 00 - ELECTRIC TRACTION ELEVATORS. Requirements for elevators.
J. Section 14 24 00 - HYDRAULIC ELEVATORS. Requirements for elevators.
K. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
L. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
M. Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
N. Section 26 05 41 - UNDERGROUND ELECTRICAL CONSTRUCTION. Requirements for underground installation of wiring.
O. Section 26 56 00 - EXTERIOR LIGHTING. Requirements for perimeter lighting.
P. Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS General electrical requirements that are common to more than one section in Division 27
Q. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
R. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS Conduits for cables and wiring.
S. Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS Labeling and Identification for cables and wiring.
T. Section 27 11 00, TELECOMMUNICATIONS EQUIPMENT ROOM FITTINGS Infrastructure for TRs, MRS, and Entrance Rooms.
U. Section 27 11 16, COMMUNICATIONS CABINETS RACKS FRAMES AND ENCLOSURES Cabinets, Racks, and TEs.
V. Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS. Copper Cabling Terminations
W. Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING Fiber Optic Backbone
X. Section 27 15 13, COMMUNICATIONS COPPER HORIZONTAL CABLING Copper Horizontal Cabling
Y. Section 27 16 19, COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS-CONNECT WIRE Copper and Fiber Patch Cables

1.03 SUBMITTALS

Submit in accordance with

A. Section 01 33 23, SHOP DRAWINGS PRODUCT DATA AND SAMPLES
B. Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS

In addition to requirements of Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS provide:

1. Pictorial layout drawing of each main computer room, entrance room, telecommunications room, showing termination cabinets, each distribution cabinet and rack, as each is expected to be installed and configured.
2. List of test equipment as per 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS

C. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

E. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

F. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for Commissioning.

G. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEMS (PACS). For physical access control integration.

H. Section 28 13 16 - PHYSICAL ACCESS CONTROL SYSTEM AND DATABASE MANAGEMENT. Requirements for control and operation of all security systems.

I. Section 28 13 53 - SECURITY ACCESS DETECTION. Requirements for screening of personnel and shipments.

J. Section 28 16 00 - INTRUSION DETECTION SYSTEM (IDS). Requirements for alarm systems.

K. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

L. Section 28 26 00 - ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS). Requirements for emergency and interior communications.

M. Section 32 31 13 - CHAIN LINK FENCES AND GATES. Requirements for fences.

N. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

O. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately

P. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

Q. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete

and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the end user to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:

1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 10 - Design Submittal Procedures, which outline basic submittal requirements and coordination. Section 01 33 10 shall be used in conjunction with this section.
2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with CAD Standards CAD Standard Application Guide, and BIM Guide. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.

R. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
   1. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
      a. Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
      b. Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
   2. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
   3. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
   4. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.
   5. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.
      a. Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
      b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.

c. Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16” tall.

6. Manual Content: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
   a. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
   b. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
   c. The manuals shall include:
      1) Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
      2) A control sequence describing start-up, operation, and shutdown.
      3) Description of the function of each principal item of equipment.
      4) Installation and maintenance instructions.
      5) Safety precautions.
      6) Diagrams and illustrations.
      7) Testing methods.
      8) Performance data.
      9) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
      10) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
   d. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.
   e. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.
   f. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
   g. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.
   h. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these

drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

i. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

j. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

k. Calculations: Provide a section for circuit and panel calculations.

l. Loading Sheets: Provide a section for DGP Loading Sheets.

m. Certifications: Provide section for Contractor's manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.

8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

9. Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

10. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. The data package shall include the following:

    a. Section I - Drawings:

        1) General – Drawings shall conform to CAD Standards. All text associated with security details shall be 1/8" tall and meet text standard for AutoCAD™ drawings.

        2) Cover Sheet – Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.

        3) General Information Sheets – General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.

        4) Floor Plans – Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8" tall and meet text standard for AutoCAD™ drawings. Floor plans shall identify the following:

            (a) Security devices by symbol,

            (b) The associated device point number (derived from the loading sheets),

(c) Wire & cable types and counts
(d) Conduit sizing and routing
(e) Conduit riser systems
(f) Device and area detail call outs

5) Architectural details – Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,
6) Riser Diagrams – Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
7) Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
8) Interconnection Diagrams – Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.
9) Security Details:
   (a) Panel Assembly Detail – For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
   (b) Panel Details – Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
   (c) Device Mounting Details – Provide mounting detailed drawing for each security device (physical access control system, intrusion detection, video surveillance and assessment, and intercom systems) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
   (d) Details of connections to power supplies and grounding
   (e) Details of surge protection device installation
   (f) Sensor detection patterns – Each system sensor shall have associated detection patterns.
   (g) Equipment Rack Detail – For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCI wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.
   (h) Security Control Room – The contractor shall provide a layout plan for the Security Control Room. The layout plan shall identify all equipment and details associated with the installation.
   (i) Operator Console – The contractor shall provide a layout plan for the Operator Console. The layout plan shall identify all equipment and details associated with the installation. Equipment room - the contractor shall provide a layout plan for the equipment room. The layout plan shall identify all equipment and details associated with the installation.
   (j) Equipment Room – Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.
10) Electrical Panel Schedule – Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted

Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.

11) Door Schedule – A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
    (a) Item Number
    (b) Door Number (Derived from A/E Drawings)
    (c) Floor Plan Sheet Number
    (d) Standard Detail Number
    (e) Door Description (Derived from Loading Sheets)
    (f) Data Gathering Panel Input Number
    (g) Door Position or Monitoring Device Type & Model Number
    (h) Lock Type, Model Number & Power Input/Draw (standby/active)
    (i) Card Reader Type & Model Number
    (j) Shunting Device Type & Model Number
    (k) Sounder Type & Model Number
    (l) Manufacturer
    (m) Misc. devices as required
        (1) Delayed Egress Type & Model Number
        (2) Intercom
        (3) Camera
        (4) Electric Transfer Hinge
        (5) Electric Pass-through device
    (n) Remarks column indicating special notes or door configurations
12) Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the Resident Engineer to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
    (a) Item Number
    (b) Camera Number
    (c) Naming Conventions
    (d) Description of Camera Coverage
    (e) Camera Location
    (f) Floor Plan Sheet Number
    (g) Camera Type
    (h) Mounting Type
    (i) Standard Detail Reference
    (j) Power Input & Draw
    (k) Power Panel Location
    (l) Remarks Column for Camera
13) Section II – Data Gathering Panel Documentation Package
    (a) Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
    (b) The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. A separate spreadsheet file shall be generated for each DGP and associated field panels.

(c) The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.

(d) All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.

(e) The DGP spreadsheet shall include an entry section for the following information:
   (1) DGP number
   (2) First Reader Number
   (3) First Monitor Point Number
   (4) First Relay Number
   (5) DGP, input or output Location
   (6) DGP Chain Number
   (7) DGP Cabinet Tamper Input Number
   (8) DGP Power Fail Input Number
   (9) Number of Monitor Points Reserved For Expansion Boards
   (10) Number of Control Points (Relays) Reserved For Expansion Boards

(f) The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
   (1) System Numbers for Card Readers
   (2) System Numbers for Monitor Point Inputs
   (3) System Numbers for Control Points (Relays)
   (4) Next DGP or input module First Monitor Point Number
   (5) Next DGP or output module First Control Point Number

(g) The DGP spreadsheet shall provide the following information for each card reader:
   (1) DGP Reader Number
   (2) System Reader Number
   (3) Cable ID Number
   (4) Description Field (Room Number)
   (5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
   (6) Description Field
   (7) DGP Input Location
   (8) Date Test
   (9) Date Passed
   (10) Cable Type
   (11) Camera Numbers (of cameras viewing the reader location)

(h) The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).
   (1) DGP Monitor Point Input Number
   (2) System Monitor Point Number
   (3) Cable ID Number
   (4) Description Field (Room Number)
   (5) Description Field (Device Type i.e.: Door Contact,Motion Detector, etc.)
   (6) DGP or input module Input Location
   (7) Date Test

(8) Date Passed
(9) Cable Type
(10) Camera Numbers (of associated alarm event preset call-ups)

(i) The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
(1) DGP Control Point (Relay) Number
(2) System (Control Point) Number
(3) Cable ID Number
(4) Description Field (Room Number)
(5) Description Field (Device: Lock Control, Local Sounder, etc.)
(6) Description Field
(7) DGP or OUTPUT MODULE Output Location
(8) Date Test
(9) Date Passed Cable Type
(10) Camera Number (of associated alarm event preset call-ups)

(j) The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
(1) Header
(2) DGP Input and Output Worksheet
(3) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
(4) Footer
(5) File Name
(6) Date Printed
(7) Page Number
(8) Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
(9) Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
(10) Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and

1.04 DEFINITIONS

A. AGC: Automatic Gain Control.

B. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

C. BICSI: Building Industry Consulting Service International.

D. CCD: Charge-coupled device.

E. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

F. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

G. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

H. CPU: Central processing unit.

I. Credential: Data assigned to an entity and used to identify that entity.

J. DGP: Data Gathering Panel – component of the Physical Access Control System capable to communicate, store and process information received from readers, reader modules, input modules, output modules, and Security Management System.

K. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.

L. EMI: Electromagnetic interference.

M. EMT: Electric Metallic Tubing.

N. ESS: Electronic Security System.

O. File Server: A PC in a network that stores the programs and data files shared by users.

P. GFI: Ground fault interrupter.

Q. IDC: Insulation displacement connector.

R. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

S. I/O: Input/Output.

T. Intrusion Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

U. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

V. LAN: Local area network.

W. LCD: Liquid-crystal display.

X. LED: Light-emitting diode.

Y. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

Z. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

AA. M-JPEG: Motion – Joint Photographic Experts Group.

BB. MPEG: Moving picture experts group.

CC. NEC: National Electric Code

DD. NEMA: National Electrical Manufacturers Association

EE. NFPA: National Fire Protection Association

FF. NTSC: National Television System Committee.

GG. NRTL: Nationally Recognized Testing Laboratory.

HH. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

II. PACS: Physical Access Control System; A system comprised of cards, readers, door controllers, servers and software to control the physical ingress and egress of people within a given space

JJ. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

KK. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

LL. PDF (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

MM. RCDD: Registered Communications Distribution Designer.

NN. RFI: Radio-frequency interference.

OO. RIGID: Rigid conduit is galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.

PP. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

QQ. RS-485: An TIA/EIA standard for multipoint communications.

RR. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

SS. SMS: Security Management System – A SMS is software that incorporates multiple security subsystems (e.g., physical access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.

TT. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

UU. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

VV. UPS: Uninterruptible Power Supply

WW. UTP: Unshielded Twisted Pair

XX. Workstation: A PC with software that is configured for specific limited security system functions.

1.05 QUALITY ASSURANCE

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:
   1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
   2. The end user reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Contractor Qualification:
   1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies

of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 ???insert number??? miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within // four // eight // hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.06 GENERAL ARANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner's representative for his or her comment and/or approval before initiating work.

B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.07 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. B. The end user's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

D. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. //Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed. //
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the end user to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:
   1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 10 - Design Submittal Procedures, which outline basic submittal requirements and coordination. Section 01 33 10 shall be used in conjunction with this section.
   2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
   3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
   4. Manufacturer’s information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
   5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with CAD Standard Application Guide, and BIM Guide. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.
   6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
      a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
         1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
         2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.

b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.
e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.
    1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
    2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.
    3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16” tall.
f. Manual Content: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
    1) Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
    2) Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
    3) The manuals shall include:
        (a) Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
        (b) A control sequence describing start-up, operation, and shutdown.
        (c) Description of the function of each principal item of equipment.
        (d) Installation and maintenance instructions.
        (e) Safety precautions.
        (f) Diagrams and illustrations.
        (g) Testing methods.
        (h) Performance data.
        (i) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
        (j) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.
h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and

telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.

i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.

j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.

k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

l. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

n. Calculations: Provide a section for circuit and panel calculations.

o. Loading Sheets: Provide a section for DGP Loading Sheets.

p. Certifications: Provide section for Contractor's manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.

8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

F. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. The data package shall include the following:

1. Section I - Drawings:
    a. General – Drawings shall conform to CAD Standards Guide. All text associated with security details shall be 1/8” tall and meet text standard for AutoCAD™ drawings.
    b. Cover Sheet – Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
    c. General Information Sheets – General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
    d. Floor Plans – Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8” tall and meet text standard for AutoCAD™ drawings. Floor plans shall identify the following:
        1) Security devices by symbol,
        2) The associated device point number (derived from the loading sheets),
        3) Wire & cable types and counts
        4) Conduit sizing and routing
        5) Conduit riser systems
        6) Device and area detail call outs
    e. Architectural details – Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,
    f. Riser Diagrams – Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
    g. Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
    h. Interconnection Diagrams – Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.
    i. Security Details:
        1) Panel Assembly Detail – For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
        2) Panel Details – Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
        3) Device Mounting Details – Provide mounting detailed drawing for each security device (physical access control system, intrusion detection, video surveillance and assessment, and intercom systems) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
        4) Details of connections to power supplies and grounding
        5) Details of surge protection device installation
        6) Sensor detection patterns – Each system sensor shall have associated detection patterns.
        7) Equipment Rack Detail – For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCI wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.

8) Security Control Room – The contractor shall provide a layout plan for the Security Control Room. The layout plan shall identify all equipment and details associated with the installation.
9) Operator Console – The contractor shall provide a layout plan for the Operator Console. The layout plan shall identify all equipment and details associated with the installation. Equipment room - the contractor shall provide a layout plan for the equipment room. The layout plan shall identify all equipment and details associated with the installation.
10) Equipment Room – Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.

j. Electrical Panel Schedule – Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.

k. Door Schedule – A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
1) Item Number
2) Door Number (Derived from A/E Drawings)
3) Floor Plan Sheet Number
4) Standard Detail Number
5) Door Description (Derived from Loading Sheets)
6) Data Gathering Panel Input Number
7) Door Position or Monitoring Device Type & Model Number
8) Lock Type, Model Number & Power Input/Draw (standby/active)
9) Card Reader Type & Model Number
10) Shunting Device Type & Model Number
11) Sounder Type & Model Number
12) Manufacurer
13) Misc. devices as required
(a) Delayed Egress Type & Model Number
(b) Intercom
(c) Camera
(d) Electric Transfer Hinge
(e) Electric Pass-through device
14) Remarks column indicating special notes or door configurations

2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the Resident Engineer to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
a. Item Number
b. Camera Number
c. Naming Conventions
d. Description of Camera Coverage
e. Camera Location
f. Floor Plan Sheet Number
g. Camera Type
h. Mounting Type
i. Standard Detail Reference
j. Power Input & Draw

k. Power Panel Location
l. Remarks Column for Camera

3. Section II – Data Gathering Panel Documentation Package
   a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
   b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. A separate spreadsheet file shall be generated for each DGP and associated field panels.
   c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.
   d. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
   e. The DGP spreadsheet shall include an entry section for the following information:
      1) DGP number
      2) First Reader Number
      3) First Monitor Point Number
      4) First Relay Number
      5) 5)DGP, input or output Location
      6) 6DGP Chain Number
      7) 7DGP Cabinet Tamper Input Number
      8) 8)DGP wer Fail Input Number
      9) Number of Monitor Points Reserved For Expansion Boards
      10) Number of Control Points (Relays) Reserved For Expansion Boards
   f. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
      1) System Numbers for Card Readers
      2) System Numbers for Monitor Point Inputs
      3) 3)System Numbers for Control Points (Relays)
      4) Next DGP or input module First Monitor Point Number
      5) Next DGP or output module First Control Point Number
   g. The DGP spreadsheet shall provide the following information for each card reader:
      1) DGP Reader Number
      2) System Reader Number
      3) Cable ID Number
      4) Description Field (Room Number)
      5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
      6) Description Field
      7) DGP Input Location
      8) Date Test
      9) Date Passed
      10) Cable Type
      11) Camera Numbers (of cameras viewing the reader location)
   h. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).

1) DGP Monitor Point Input Number
2) System Monitor Point Number
3) Cable ID Number
4) Description Field (Room Number)
5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
6) DGP or input module Input Location
7) Date Test
8) Date Passed
9) Cable Type
10) Camera Numbers (of associated alarm event preset call-ups)

i. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
1) DGP Control Point (Relay) Number
2) System (Control Point) Number
3) Cable ID Number
4) Description Field (Room Number)
5) Description Field (Device: Lock Control, Local Sounder, etc.)
6) Description Field
7) DGP or OUTPUT MODULE Output Location
8) Date Test
9) Date Passed Cable Type
10) Camera Number (of associated alarm event preset call-ups)

j. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
1) Header
(a) DGP Input and Output Worksheet
(b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
2) Footer
(a) File Name
(b) Date Printed
(c) Page Number

4. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must be considered to determine installation means and methods for approval by the owner.
5. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
6. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.

c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.

7. Section VI – Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

G. Group II Technical Data Package

1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the Resident Engineer documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the Architect.
2. System Configuration and Functionality: The contractor shall provide the results of the meeting with the Architect to develop system requirements and functionality including but not limited to:
   a. Baseline configuration
   b. Access levels
   c. Schedules (intrusion detection, physical access control, holidays, etc.)
   d. Badge database
   e. System monitoring and reporting (unit level and central control)
   f. Naming conventions and descriptors

H. Group III Technical Data Package

1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The Contractor will deliver the test procedures to the Resident Engineer for approval at least 60 calendar days prior to the requested test date.

I. Group IV Technical Data Package

1. Performance Verification Test
   a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the Resident Engineer for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.
2. Training Documentation
   a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.
   b. New Unit Control Room:
      1) Provide the security personnel with training in the use, operation, and maintenance of the entire control room system (Unit Control and Equipment Rooms). The training documentation must include the operation and maintenance. The first of the training sessions shall take place prior to system turnover and the second immediately after turnover. Coordinate the training sessions with the Owner. Completed classroom sessions will be witnessed and

documented by the Architect/Engineer, and approved by the Resident Engineer. Instruction is not to begin until the system is operational as designed.

2) The training documents will cover the operation and the maintenance manuals and the control console operators' manuals and service manuals in detail, stressing all important operational and service diagnostic information necessary for the maintenance and operations personnel to efficiently use and maintain all systems.
3) Provide an illustrated control console operator's manual and service manual. The operator's manual shall be written in laymen's language and printed so as to become a permanent reference document for the operators, describing all control panel switch operations, graphic symbol definitions and all indicating functions and a complete explanation of all software.
4) The service manual shall be written in laymen's language and printed so as to become a permanent reference document for maintenance personnel, describing how to run internal self diagnostic software programs, troubleshoot head end hardware and field devices with a complete scenario simulation of all possible system malfunctions and the appropriate corrective measures.
5) Provide a professional color DVD instructional recording of all the operational procedures described in the operator's manual. All charts used in the training session shall be clearly presented on the video. Any DVD found to be inferior in recording or material content shall be reproduced at no cost until an acceptable DVD is submitted. Provide four copies of the training DVD, one to the architect/engineer and three to the owner.

3. System Configuration and Data Entry:
   a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video matrix switch, intercom, digital video recorders, network video recorders). The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:
      1) Physical Access control system components,
      2) All intrusion detection system components,
      3) Video surveillance, control and recording systems,
      4) Intercom systems components,
      5) All other security subsystems shown in the contract documents.
   b. Refer to Part 3 for system programming requirements and planning guidelines.
4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and request from the COTR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

J. Group V Technical Data Package: Final copies of the manuals shall be delivered to the Resident Engineer as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and

telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. //Six (6) hard-copies and one (1) soft copy on CD// of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
    a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer’s repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
    a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.
4. Operator’s Manual: The operator’s manual shall fully explain all procedures and instructions for the operation of the system, including:
    a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands’ alarm messages, and printing formats; and system access requirements.
5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the Resident Engineer a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the end user. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
    a. Equipment and/or system function.
    b. Operating characteristics.
    c. Limiting conditions.
    d. Performance curves.
    e. Engineering data and test.
    f. Complete nomenclature and number of replacement parts.

g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
h. Provide information detailing essential maintenance procedures including the following: routine operations, trouble shooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
j. Manufacturer equipment and systems maintenance manuals are permissible.

9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the Resident Engineer or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the Resident Engineer for review and approval of all changes or modifications to the documents. Each sheet shall have Resident Engineer initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".
10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the end user. As with master relines, Contractor shall maintain record specifications for Resident Engineer review and inspection at anytime.
11. Record Product Data: The Contractor shall maintain one (1) copy of eac Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the end user.
12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include a minimum of the following:
    a. Certificates received instead of labels on bulk products.

b. Testing and qualification of tradesmen. (“Contractor’s Qualifications”)
c. Documented qualification of installation firms.
d. Load and performance testing.
e. Inspections and certifications.
f. Final inspection and correction procedures.
g. Project schedule

13. Record Construction Documents (Record As-Built)
    a. Upon project completion, the contractor shall submit the project master redlines to the Resident Engineer prior to development of Record construction documents. The Resident Engineer shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the Resident Engineer, the Resident Engineer will initial and date each sheet and turn redlines over to the contractor for as built development.
    b. The Contractor shall provide the Resident Engineer a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the end user. If, in the opinion of the end user, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the Owner. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the owner.
    c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the end user. The Contractor shall organize into bound and labeled sets for the end user's continued usage. Provide device, conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

K. L. Approvals will be based on complete submission of manuals together with shop drawings.

L. M. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
1. 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
2. 2. Each type of conduit and pathway coupling, bushing and termination fitting.
3. 3. Conduit hangers, clamps and supports.
4. 4. Duct sealing compound.

M. N. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

1.08 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/ International Code Council (ICC):

A117.1 Standard on Accessible and Usable Buildings and Facilities

C. American National Standards Institute (ANSI)/ Security Industry Association (SIA):

AC-03 Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards

CP-01-00 Control Panel Standard-Features for False Alarm Reduction

PIR-01-00 Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity

TVAC-01 CCTV to Access Control Standard - Message Set for System Integration

D. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):

330-09 Electrical Performance Standards for CCTV Cameras

375A-76 Electrical Performance Standards for CCTV Monitors

E. American National Standards Institute (ANSI):

ANSI S3.2-99 Method for measuring the Intelligibility of Speech over Communications Systems

F. American Society for Testing and Materials (ASTM)

B1-07 Standard Specification for Hard-Drawn Copper Wire

B3-07 Standard Specification for Soft or Annealed Copper Wire

B8-04 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C1238-97 (R03) Standard Guide for Installation of Walk-Through Metal Detectors

D2301-04 Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

G. Architectural Barriers Act (ABA), 1968

H. Department of Justice: American Disability Act (ADA)

28 CFR Part 36-2010 ADA Standards for Accessible Design

I. FederalCommunications Commission (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

A-A-59544-08 Cable and Wire, Electrical (Power, Fixed Installation)

J. Institute of Electrical and Electronics Engineers (IEEE):

81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

802.3af-08 Power over Ethernet Standard

802.3at-09 Power over Ethernet (PoE) Plus Standard

C2-07 National Electrical Safety Code

C62.41-02 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

C95.1-05 Standards for Safety Levels with Respect to Human Exposure in Radio Frequency Electromagnetic Fields

K. International Organization for Standardization (ISO):

7810 Identification cards – Physical characteristics

7811 Physical Characteristics for Magnetic Stripe Cards

7816-1 Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics

7816-2 Identification cards - Integrated circuit cards - Part 2: Cards with contacts -Dimensions and location of the contacts

7816-3 Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols

7816-4 Identification cards - Integrated circuit cards - Part 11: Personal verification through biometric methods

7816-10 Identification cards - Integrated circuit cards - Part 4: Organization, security and commands for interchange

14443 Identification cards - Contactless integrated circuit cards; Contactless Proximity Cards Operating at 13.56 MHz in up to 5 inches distance

15693 Identification cards -- Contactless integrated circuit cards - Vicinity cards; Contactless Vicinity Cards Operating at 13.56 MHz in up to 50 inches distance

19794 Information technology - Biometric data interchange formats

L. National Electrical Contractors Association

303-2005 Installing Closed Circuit Television (CCTV) Systems

M. National Electrical Manufactures Association (NEMA):

250-08 Enclosures for Electrical Equipment (1000 Volts Maximum)

TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

N. National Fire Protection Association (NFPA):

70-11 National Electrical Code (NEC)

731-08 Standards for the Installation of Electric Premises Security Systems

99-2005 Health Care Facilities

O. National Institute of Justice (NIJ)

0601.02-03 Standards for Walk-Through Metal Detectors for use in Weapons Detection

0602.02-03 Hand-Held Metal Detectors for Use in Concealed Weapon and Contraband Detection

P. National Institute of Standards and Technology (NIST):

Special Pub 800-37 Guide for Applying the Risk Management Framework to Federal Information Systems

Special Pub 800-63 Electronic Authentication Guideline

Special Pub 800-73-3 Interfaces for Personal Identity Verification (4 Parts)
- Pt. 1 - End Point PIV Card Application Namespace, Data Model & Representation
- Pt. 2 - PIV Card Application Card Command Interface
- Pt. 3 - PIV Client Application Programming Interface
- Pt. 4 - The PIV Transitional Interfaces & Data Model Specification

Special Pub 800-76-1 Biometric Data Specification for Personal Identity Verification

Special Pub 800-78-2 Cryptographic Algorithms and Key Sizes for Personal Identity Verification

Special Pub 800-79-1 Guidelines for the Accreditation of Personal Identity Verification Card Issuers

Special Pub 800-85B-1 DRAFTPIV Data Model Test Guidelines

Special Pub 800-85A-2 PIV Card Application and Middleware Interface Test Guidelines (SP 800-73-3 compliance)

Special Pub 800-96 PIV Card Reader Interoperability Guidelines

Special Pub 800-104A Scheme for PIV Visual Card Topography

Q. Occupational and Safety Health Administration (OSHA):
29 CFR 1910.97 Nonionizing radiation

R. Section 508 of the Rehabilitation Act of 1973

S. Security Industry Association (SIA):
AG-01 Security CAD Symbols Standards

T. Underwriters Laboratories, Inc. (UL):
1-05 Flexible Metal Conduit
5-04 Surface Metal Raceway and Fittings
6-07 Rigid Metal Conduit
44-05 Thermoset-Insulated Wires and Cables
50-07 Enclosures for Electrical Equipment
83-08 Thermoplastic-Insulated Wires and Cables
294-99 The Standard of Safety for Access Control System Units
305-08 Standard for Panic Hardware
360-09 Liquid-Tight Flexible Steel Conduit
444-08 Safety Communications Cables
464-09 Audible Signal Appliances
467-07 Electrical Grounding and Bonding Equipment
486A-03 Wire Connectors and Soldering Lugs for Use with Copper Conductors
486C-04 Splicing Wire Connectors
486D-05 Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
486E-00 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-07 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
514A-04 Metallic Outlet Boxes
514B-04 Fittings for Cable and Conduit
51-05 Schedule 40 and 80 Rigid PVC Conduit
609-96 Local Burglar Alarm Units and Systems
634-07 Standards for Connectors with Burglar-Alarm Systems
636-01 Standard for Holdup Alarm Units and Systems
639-97 Standard for Intrusion-Detection Units
651-05 Schedule 40 and 80 Rigid PVC Conduit
651A-07 Type EB and A Rigid PVC Conduit and HDPE Conduit
752-05 Standard for Bullet-Resisting Equipment
797-07 Electrical Metallic Tubing
827-08 Central Station Alarm Services
1037-09 Standard for Anti-theft Alarms and Devices
1635-10 Digital Alarm Communicator System Units
1076-95 Standards for Proprietary Burglar Alarm Units and Systems
1242-06 Intermediate Metal Conduit
1479-03 Fire Tests of Through-Penetration Fire Stops

1981-03 Central Station Automation System

2058-05 High Security Electronic Locks

60950 Safety of Information Technology Equipment

60950-1 Information Technology Equipment - Safety - Part 1: General Requirements

U. Uniform Federal Accessibility Standards (UFAS) 1984

V. United States Department of Commerce:

Special Pub 500-101 Care and Handling of Computer Magnetic Storage Media

1.09 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

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

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

1.10 MAITENANCE & SERVICE

A. General Requirements
   1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work
   1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel
   1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The Resident Engineer shall be advised in writing of the name of the designated service representative, and of any change in personnel. The Resident Engineer shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work
   1. The ork shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

E. System Inspections
   1. These inspections shall include:
      a. The ontractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.

1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

F. Emergency Service
1. The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Owner with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
   a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from notification. Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.
   b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

G. Operation
1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

H. Records & Logs
1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

I. Work Rquest
1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

J. System Modifications
1. The Cotractor shall make any recommendations for system modification in writing to the Resident Engineer. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the Resident Engineer. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

K. Softwe
1. The Contractor shall provide all software updates when approved by the Owner from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and

validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

1.11 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.12 DELIVERY, STORAGE, & HANDLING

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
   1. Dring installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
   2. Damed equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
   3. Painte surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
   4. Damagedpaint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

B. CentralStation, Workstations, and Controllers:
   1. Store in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 10 to 30 deg C (50 to 85 deg F), and not more than 80 percent relative humidity, non-condensing.
   2. Open ech container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
   3. Mark packing list with designations which have been assigned to materials and equipment for recording in the system labeling schedules generated by cable and asset management system.
   4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.13 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
   1. Interir, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 2 to 50 deg C (36 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
   2. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4X enclosures.
   3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 610 mm (24 in) thick. NEMA 250, Type 4X enclosures.

4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
5. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

B. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.

C. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent.

1.14 EQUIPMENT ANDMATERIALS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipmet Assemblies and Components:
1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:
1. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.

1.15 ELECTRICAL POWER

A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the PACS and the Uninterruptible Power Supply (UPS) system so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.

B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for 8 ???insert hours??? hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.
1. Emergency Generator
    a. Report Printers: Unit Control Room
    b. Video Monitors: Unit Control Room
    c. Intercom Stations
    d. Radio System
    e. Lights: Unit Control Room, Equipment Rooms, & Security Offices
    f. Outlets: Security Outlets dedicated to security equipment racks or security enclosure assemblies.

g. Security Device Power Supplies (DGP, VASS, Card Access, Lock Power, etc.) powered from the security closets or remotely: various locations
h. Telephone/Radio Recording Equipment: Unit Control Room.
i. VASS Camera Power Supplies: Security Closets
j. VASS Pan/Tilt Units: Various Locations
k. VASS Outdoor Housing Heaters and Blowers: Various Sites
l. Intercom Master Control System
m. Fiber Optic Receivers/Transmitters
n. Securityoffice Weapons Storage
o. Outlets that charge handheld radios

2. Uninterruptible Power Supply (UPS) on Emergency Power
   a. The folloing 120VAC circuits shall be provided by others. The Security Contractor shall coordinate exact locations with the Electrical Contractor:
      1) Security System Monitors and Keyboards: Control Room
      2) CPU: Control Equipment Room
      3) Communications equipment: Control Equipment Room and various sites.
      4) VASS Matrix Switcher: Control Equipment Room
      5) Control Equipment Room
      6) Digital Video Recorders, encoders & decoders: Control Room
      7) All equipment Room racked equipment.
      8) Network switches

1.16 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION, & GROUNDING

A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.
   1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
   2. An 8-mirosecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
   3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
   4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity.

B. Grounding and Surge Suppression
   1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, under ground-fault conditions.
   2. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
   3. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
   4. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.
   5. Locatios and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.

6. AC power receptacles are not to be used as a ground reference point.
7. Any cale that is shielded shall require a ground in accordance with the best practices of the trade and manufactures installation instructions.
8. Proteion should be provided at both ends of cabling.

1.17 COMPONENT ENCLOSURES

A. ConstrUction of Enclosures
   1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.
   2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
   3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
   4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open, but shall be in accessible when the door is closed.
   5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Consoles & Equipment Racks: All consoles and vertical equipment racks shall include a forced air-cooling system to be provided by others.
   1. Vertical Equipment Racks:
      a. The forced air blowers shall be installed in the vented top of each cabinet and shall not reduce usable rack space.
      b. The forced air fan shall consist of one fan rated at 105 CFM per rack bay and noise level shall not exceed 55 decibels.
      c. Vertical equipment racks are to be provided with full sized clear plastic locking doors and vented top panels as shown on contract drawings.
   2. Console racks:
      a. Forced air fans shall be installed in the top rear of each console bay. The forced air fan shall consist of one fan rated at 105 CFM mounted to a 133mm vented blank panel the noise level of each fan shall not exceed 55 decibels. The fans shall be installed so air is pulled from the bottom of the rack or cabinet and exhausted out the top.
      b. Console racks are to be provided with flush mounted hinged rear doors with recessed locking latch on the bottom and middle sections of the consoles. Provide code access to support wiring for devices located on the work surfaces.

C. TamperProvisions and Tamper Switches:
   1. Encosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches.
   2. Taer switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically

mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sign to any internal component before the switch activates.

3. Tamper witches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4 " tolerance. The tamper device or its components shall not be visible or accessing with common tools to bypass when the enclosure is in the secured mode.
4. The sile gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 305 square mm shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.
8. All security screws shall be Torx-Post Security Screws.
9. The ntractor shall provide the owner with two (2) torx-post screwdrivers.

1.18 ELECTRONIC COMPONENTS

A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

1.19 SUBSTITUTE MATERIALS & EQUIPMENT

A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. The Resident Engineer shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the Resident Engineer stating same. In the preparation of a list of substitutions, the following information shall be included, as a minimum:
   1. Identity of the material or devices specified for which there is a proposed substitution.
   2. Description of the segment of the specification where the material or devices are referenced.
   3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer's product name.
   4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-feature, between specification requirements and the material or devices called for in the specification; and Price differential.

C. Materials Not Listed: Furnish all necessary hardware, software, programing materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described

herein. Depending on the manufacturers selected by the end user, some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications, but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the Resident Engineer shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The Resident Engineer shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.

D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate “COMPLY” opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate “DOES NOT COMPLY” opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate “COMPARABLE”. The offers shall include a statement fully describing the “comparable” method of satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

1.20 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.21 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute written guarantee (warranty) to the end user certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contactor received written notification of final acceptance from the end user. Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the end user's satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the end user on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of it’s failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.22 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. All equipment associated within the Security Control Room, Security Consoleand Security Equipment Room shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

B. All equpment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 8 ???insert hours??? hours of run time in the event of a loss of primary power to the facility.

C. The sytem shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.

D. All eqpment and materials for the system will be compatible to ensure correct operation.

2.02 EQUIPMENT ITEMS

A. The Security Management System shall provide full interface with all components of the security subsystem as follows:

B. Remote security console access: For facilities that have a remote, secondary back-up control console or workstation shall apply the following requirements:
   1. The secondary stations shall the requirements outlined in Sections 2.2.A-G.
   2. Installation of an intercom station or telephone line shall be installed and provide direct one touch call-up for communications between the primary Security Control Console and secondary Security Control Console.
   3. Secondary stations shall not have priority over a primary Security Control Console.
   4. The primary Access Control System and Database Management shall have the ability to shut off power and a signal to a secondary control station in the event the area has been compromised.

C. Wires and Cables:
   1. Shall meet or exceed the manufactures recommendation for power and signals.
   2. Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
   3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
   4. All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.
   5. Conduit fills shall not exceed 50 percent unless otherwise documented.
   6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
   7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
   8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.
   9. For all equipment that is carrying digital data between the Security Control Room, Security Equipment Room, Security Console, or at a remote monitoring station, it shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

2.03 FIBER OPTIC EQUIPMENT

A. 8 Channel Fiber Optic Transcievers (Video&PTZ Control)
   1. The field-located and central-located fiber optic transceivers shall utilize wave division multiplexing to transmit and receive video and data pan-tilt-zoom control signals over two standard 62.5/125 multimode fibers.
   2. The units shall be capable of operating over a range of 2 km.
   3. The units shall be NTSC color compatible.
   4. The units shall support data rates up to 64 Kbps.
   5. The units shall be surface or rack mountable.
   6. The unts shall be UL listed.
   7. The units shall meet or exceed the following specifications:
      a. Video
         1) Input/Output: 1 volt pk-pk (75 ohms)
         2) Input/Otput Channels: 8
         3) Bandwidth: 10 Hz - 6.5 MHZ per channel
         4) Differential Gain: <2%
         5) Differential Phase: <0.7°
         6) Tilt: <1%
         7) Signal to Noise Ratio: 60 dB
      b. Data (Control)
         1) Data Channels: 2
         2) Data Format: RS-232, RS-422, 2 wire or 4 wire RS-485 with Tri-State Manchester Bi-Phase and Sensornet
         3) Data Rate: DC - 100 kbps (NRZ)
         4) Bit Error Rate: < 1 in 10-9 @ Maximum Optical Loss Budget
         5) Operating Mode: Simplex or Full-Duplex
         6) Wavelength: 1310/1550 nm, Multimode or Singlemode
         7) Optical Emitter: Laser Diode
         8) Number of Fibers: 1
      c. Connectors
         1) Optical: ST
         2) Power and Data: Terminal Block with Screw Clamps
         3) Video: BNC (Gold Plated Center-Pin)
      d. Electrical and Mechanical
         1) Power: 12 VDC @ 500 mA (stand-alone)
         2) Current Protection: Automatic Resettable Solid-State Current Limiters
      e. Environmental
         1) MTBF: > 100,000 hours
         2) Operating Temp: -40 to 74 deg C (-40 to 165 deg F)
         3) Storage Temp: -40 to 85 deg C (-40 to 185 deg F)
         4) Relative Humidity: 0% to 95% (non-condensing)

B. Fiber Optic Transmitters: The central-located fiber optic transmitters shall utilize wave division multiplexing to transmit video and signals over standard 62.5/125 multimode fibers.
   1. The units shall be capable of operating over a range of 4.8 km.
   2. The units shall be NTSC color compatible.
   3. The units shall support data rates up to 64 Kbps.
   4. The units shall be surface or rack mountable.
   5. The units shall be UL listed.
   6. The units shall meet or exceed the following specifications:
      a. Video
         1) Input: 1 volt pk-pk (75 ohms)
         2) Bandwidth: 5H2 - 10 MHZ

3) Differential Gain: <5%
4) Tilt: <1%
5) Signal-Noise: 60db
6) Wavelength: 850nm
7) Number of Fibers: 1
8) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
9) Connectors:
   (a) Power: Female plug with screw clamps
   (b) Video: BNC
   (c) Optical: ST
10) Power: 12 VDC

C. Fiber Optic Receivers: The field-located fiber optic receivers shall utilize wave division multiplexing to receive video signals over standard 62.5/125 multimode fiber.
1. The units shall be capable of operating over a range of 4.8 km.
2. The units shall be NTSC color compatible.
3. The units shall support data rates up to 64 Kbps.
4. The units shall be surface or rack mountable.
5. The units shall be UL listed.
6. he units shall meet or exceed the following specifications:
   a. Video
      1) Output: 1 volt pk-pk (75 ohms)
      2) Bandwidth: 5H2 - 10 MHZ
      3) Differential Gain: <5%
      4) Tilt: <1%
      5) Signal-Noise: 60dB
      6) Wavelength: 850nm
      7) Number of Fibers: 1
      8) Surface Mount: 106.7 x 88.9 x 25.4 mm (4.2 x 3.5 x 1 in)
      9) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
      10) Connectors:
      11) Power: Female plug block with screw clamps
      12) Video: BNC
      13) Optical: ST
      14) Power: 12 VAC8 Channel Fiber Optic Transcievers (Video&PTZ Control)

D. Fiber Optic Sub Rack with Power Supply
1. The Card Cage Rack shall provide high-density racking for fiber-optic modules. The unit shall be designed to mount in standard 483 mm (19 in) instrument racks and to accommodate the equivalent of 15 1-inch modules.
   a. Specifications
      1) Card Orientation: Vertical
      2) Construction: Aluminum
      3) Current Consumption: 0.99 A
      4) Humidity: 95.0 % RH
      5) Input Power: 100-240 VAC, 60/50 Hz
      6) Mounting: Mounts in standard 483 mm (19 in) rack using four (4) screws (optional wall brackets purchased separately)
      7) Numbe of Outputs: 1.0
      8) Number of Slots 15.0
      9) Operating Temperature: -40 to +75 deg C (-40.0 to 167.0 deg F)
      10) Ouput Voltage: 13.5 V
      11) Output Current 6.0 A
      12) Power Dissipation: 28.0 W

13) Power Factor: 48.0
14) Power Supply: (built-in)
15) Rack Units: 3RU
16) Redundant Capability: Yes
17) Weight: 2.43 kg (5.35 lb)
18) Width: 483 mm (19.0 in)

2.04 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES (TVSS) AND SURGE SUPPRESION

A. Tansient Voltage Surge Suppression
1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:
   a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
   b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
   c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
   d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

B. Physical Accs Control Systems
1. Suppressors shall be installed on AC power at the point of service and shall meet the following criteria:
   a. UL 1449 2nd Edition, 2007, listed
   b. UL 1449 S.V.R. o 400 Volts or lower
   c. Status Indicator Light(s)
   d. Minimum Surge Current Capacity: 40,000 Amps (8 x 20 µsec)
   e. Maximum Continuous Current: 15 Amps
   f. MCOV: 125 VAC
   g. Service Voltage: 110-120 VAC
2. Suppressors shall be installed on the Low Voltage circuit at both the point of entrance and exit of the building. Suppressors shall meet the following criteria:
   a. UL 497B
   b. Minimum Surge Current Capacity: 2,000 Amps per pair
   c. Maximum Continuous Current: 5 Amps
   d. MCOV 33 Volts
   e. Service Voltage: 24Volts
3. Suppressors shall be installed on the communication circuit between the access controller and card reader at both the entrance and exit of the building. Suppressors shall meet the following criteria:
   a. Conforms with UL 497B standards (where applicable)
   b. Clamp level for 12 and 24V power: 18VDC / 38VDC
   c. Clamp level for Data/LED: 6.8VDC
   d. Service Voltage for Power: 12VDC/24VDC
   e. Service Voltage for Data/LED: <5VDC
   f. Clamp level – PoE Access Power: 72V
   g. Clamp level – PoE Access Data: 7.9V
   h. Service Voltage – PoE Access: 48VAC – 54VAC

i. Service Voltage – PoE Data: <5VDC

C. Intercom Systems
1. Suppressors shall be installed on the AC power at the point of service and shall meet the following criteria:
a. UL 1449 Listed
b. UL 1449 S.V.R. of 400 Volts or lower
c. Diagnostic Indicator Light(s)
d. Integrated ground terminating post (where case/chassis ground exists)
e. Minimum Surge Current Capacity of 13,000 Amps (8 x 20 µSec)
2. Suppressors shall be installed on incoming central office lines and shall meet the following criteria:
a. UL 497A Listed
b. Multi Stage protection design
c. Auto-reset current protection not to exceed 2 Amps per pair
d. Minimum Surge Current of 500 Amps per pair (8 x 20 µSec)
3. Suppressors shall be installed on all telephone/intercom circuits that enter or leave separate buildings and shall meet the following criteria:
a. UL 497A Listed (where applicable)
b. UL 497B Listed (horns, strobes, speakers or communication circuits over 300 feet)
c. Multi Stage protection design
d. Auto-reset over-current protection not to exceed 5 Amps per pair
e. Minimum Surge Current of 1000 Amps per pair (8 x 20 µSec)

D. Intrusion Detection Systems
1. Suppressors shall be installed on AC at the point of service and shall meet the following criteria:
a. UL 1449, 2nd Edition 2007, listed
b. UL 1449 S.V.R. of 400 Volts or lower
c. Status Indicator Lights
d. Center screw for terminating Class II transformers
e. Minimum Surge Current Capacity of 32,000 Amps (8 x 20 µSec)
2. Suppressors shall be installed on all Telephone Communication Interface circuits and shall meet the following criteria:
a. UL 497A Listed
b. Multi Stage protection design
c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
d. Clamp Voltage: 130Vrms
e. Auto reset current protection not to exceed 150 milliAmps
3. Suppressors shall be installed on all burglar alarm initiating and signaling loops and addressable circuits which enter or leave separate buildings. The following criteria shall be met:
a. UL 497B for data communications or annunciation (powered loops)
b. Fail-short/fail-safe mode.
c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
d. Clamp Voltage: 15 Vrms
e. Joule Rating: 76 Joules per pair (10x1000 µSec)
f. Auto-reset current protection not to exceed 150 milliAmps for UL 497A devices.

E. Video Surveillance System
1. Protectors shall be installed on coaxial cable systems on points of entry and exit from separate buildings. Suppressors shall be installed at each exterior camera location and include protection for 12 and/or 24 volt power, data signal and motor controls (for Pan, Tilt and Zoom systems). SPDs shall protect all modes herein mentioned and contain all modes in a single unit system. Protection for all systems mentioned above shall be

incorporated at the head end equipment. Additionally a minimum 450VA battery back up shall be used to protect the DVR or VCR and monitor. Protectors shall meet the following criteria:

a. Head-End Power
    1) UL 1778, cUL (Battery Back Up)
    2) Minimum Surge Current Capacity: 65,000 Amps (8x20µsec)
    3) Minimum of two (2) NEMA 5-15R Receptacles (one (1) AC power only, one (1) with UPS)
    4) All modes protected (L-N, L-G, N-G)
    5) EMI/RFI Filtering
    6) Maximum Continuous Current: 12 Amps
b. Camera Power
    1) Minimum Surge Current Capacity: 1,000 Amps (8X20µsec); 240 Amps for IP Video/PoE cameras
    2) Screw Terminal Connection
    3) All protection modes L-G (all Lines)
    4) MCOV <40VAC
c. Video An Data
    1) Surge Current Capacity 1,000 Amps per conductor
    2) “BNC” Connection (Coax)
    3) Protection modes: L-G (Data), Center Pin-G, Shield-G (Coax)
    4) Band Pass 0-2GHz
    5) Insertion Loss <0.3dB

F. Grounding and Surge Suppression
    1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
    2. The Contractor shall engineer, provide, ad install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.
    3. Principal grounding components and features shall include: main grounding buses, grounding, and bonding connections to service equipment.
    4. The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
    5. The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
    6. AC power receptacles are not to be used as a ground reference point.
    7. Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufactures’ installation instructions.

G. 120 VAC Srge Suppression
    1. Continuous Current: Unlimited (parallel connection)
    2. Max Surge Current: 13,500 Amps
    3. Protection Modes: L - N, L - G, N - G
    4. Warranty: Ten Year Limited Warranty
    5. Dimension: 73.7 x 41.1 x 52.1 mm (2.90 x 1.62 x 2.05 in)
    6. Weight: 2.88 g (0.18 lbs)
    7. Housing: ABS

2.05 INSTALLATION KIT

A. General:
    1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or

cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:

2. System Grounding:
   a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
   b. This includes, but is not limited to:
      1) Coaxial Cable Shields
      2) Control Cable Shields
      3) Data Cable Shields
      4) Equipment Racks
      5) Equipment Cabinets
      6) Conduits
      7) Cable Duct blocks
      8) Cable Trays
      9) Power Panels
      10) Grounding
      11) Connector Panels
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.
8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to provide the system documentation as required by this document and explained herein.

PART 3 – EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

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

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

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

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

F. Equipment location shall be as close as practical to locations shown on the drawings.

G. Inaccessible Equipment:
   1. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.02 FIRESTOPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 07 84 00 "Firestopping."

3.03 COMMISIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – COMMISIONIN OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 28 08 00 – COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.04 DEMNSTRATION AND TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

D. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 – COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

3.05 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

3.06 SYSTEM PROGRAMMING

A. General Programming Requirements
   1. This following section shall be used by the contractor to identify the anticipated level of effort (LOE) required setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and

programming to include data entry for the Security Management System (SMS) and subsystems . System programming for existing or new SMS servers shall not be conducted at the project site.

B. Level of Effort for Programming

TABLE 1 CONTRACTOR LEVEL OF EFFORT

4.01 TESTING AND ACCEPTANCE

A. Performance Requirements
   1. General:
      a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Resident Engineer at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.
   2. Test Procedures and Reports: The test procedures, compliant w/ industry standard test procedures, shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. The test reports shall be used to document results of the tests. The reports shall be delivered to the Resident Engineer within seven (7) calendar days after completion of each test.

B. Pre-Delivery Testing
   1. The purpose of the pre-delivery test is to establish that a system is suitable for installation. As such, pre-delivery test shall be a mock-up of the system as planned in the contract documents. The Contractor shall assemble the Security Test System at the Contractors local project within 50-miles of the project site, and perform tests to demonstrate the performance of the system complies with the contract requirements in accordance with the approved pre-delivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during pre-delivery testing, including results of each test procedure, shall be documented and delivered to the Resident Engineer at the conclusion of pre-delivery testing and prior to Resident Engineer's approval of the test. The test report shall be arranged so all commands, stimuli, and responses are correlated to allow logical interpretation. For Existing System modifications, the contractor shall provide their own server with loaded applicable software to support PDT.
   2. Test Setup: The pre-delivery test setup shall include the following:
      a. All console equipment.
         1) At least one of each type of data transmission media (DTM) and associated equipment to provide a fully integrated PACS.
         2) The number of local processors shall equal the amount required by the site design.
         3) Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually or software generated.
         4) Contractor to prove to owner all systems are appropriately sized and configured as sized.
         5) Integration of VASS, intercom systems, other subsystems.
   3. During the bidding process the contractor shall submit a request for information to the Owner to determine if a pre-delivery test will be required. If a pre-delivery test is not required, the contractor shall provide a written notification that the Pre-delivery Test is not required in their shop drawings submission.

C. //Intermediate Testing
   1. After completion of 30-50 percent of the installation of ESS cabinet(s) and equipment, one local and remote control stations and prior to any further work, this portion of the system

must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate FCC listing & UL certification labels are affixed, NFPA, Emergency, Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.//

D. Contractor's Field Testing (CFT)
   1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD 142. The Contractor shall test all security systems and equipment, and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated loading sheets documenting complete testing to Resident Engineer approval. CFT test documentation package shall conform to submittal requirements outlined in this Section. The Contractor's field testing procedures shall be identical to the Resident Engineer's acceptance testing procedures. The Contractor shall provide the Resident Engineer with a written listing of all equipment and software indicating all equipment and components have been tested and passed. The Contractor shall deliver a written report to the Project Manager stating the installed complete system has been calibrated, tested, and is ready to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written notice by contractor is received certifying that a contractors field test was successful.

E. Performance Verification Test (PVT)
   1. Test team:
   2. The Contractor shall demonstrate the completed Physical Access Control System PACS complies with the contract requirements. In addition, the Contractor shall provide written certification that the system is 100% operational prior to establishing a date for starting PVT. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT will be stopped and aborted as soon as 10 technical deficiencies are found requiring correction. The Contractor shall be responsible for all travel and lodging expenses incurred for out-of-town personnel required to be present for resumption of the PVT. If the acceptance test is aborted, the re-test will commence from the beginning with a retest of components previously tested and accepted.
   3. The PVT, as specified, shall not begin until receipt of written certification that the Contractors Field Testing was successful. This shall include certification of successful completion of testing as specified in paragraph "Contractor's Field Testing", and upon successful completion of testing at any time when the system fails to perform as specified. Upon termination of testing by the Resident Engineer or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.
   4. Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the Resident Engineer prior to commencing the endurance test.
   5. Additional Components of the PVT shall include:
      a. System Inventory
         1) All Device equipment
         2) All Software
         3) All Logon and Passwords
         4) All Cabling System Matrices
         5) All Cable Testing Documents
         6) All System and Cabinet Keys

b. Inspection
   1) Contractor shall record an inspection punch list noting all system deficiencies. The contractor shall prepare an inspection punch list format for Resident Engineers approval.
   2) As a minimum the punch list shall include a listing of punch list items, punch list item location, description of item problem, date noted, date corrected, and details of how item was corrected.

6. Partial PVT - At the discretion of Resident engineer, the Performance Verification Test may be performed in part should a 100% compliant CFT be performed. In the event that a partial PVT will be performed instead of a complete PVT; the partial PVT shall be performed by testing 10% of the system. The contractor shall perform a test of each procedure on select devices or equipment.

F. Endurance Test
1. The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified below. The endurance test shall not be started until the Resident Engineer notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. End user shall operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing. End user will maintain a log of all system deficiencies. The Resident Engineer may terminate testing at any time the system fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test, the Contractor shall verify the appropriate operation of the system. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Resident Engineer prior to acceptance of the system.
2. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the Resident Engineer. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the Resident Engineer.
3. Phase II (Assessment):
   a. After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Resident Engineer. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
   b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Resident Engineer. The meeting shall not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase I be repeated.
4. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the end user.
5. Phase IV (Assessment):
   a. After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the end user. The report shall explain in detail the nature of each failure, corrective action taken,

results of tests performed, and recommend the point at which testing should be resumed.

b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the end user. The meeting shall not be scheduled earlier than five (5) business days after receipt of the report by the end user. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions for the performance verification test. Based on the review meeting the test should not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As a part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase III be repeated. After the conclusion of any re-testing which the Resident Engineer may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

G. Exclusions

1. The Contractor will not be held responsible for failures in system performance resulting from the following:
   a. An outage of the main power in excess of the capability of any backup power source provided the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the PACS performed as specified.
   b. Failure of an Owner furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.
   c. Failure of existing Owner owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

END OF SECTION

SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.02 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS.

B. Section 07 84 00 - FIRESTOPPING.

C. Section 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

D. Section 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

E. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY.

F. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY.

G. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

H. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEM.

I. Section 28 16 00 - INTRUSION DETECTION SYSTEM.

J. Section 28 23 00 - VIDEO SURVEILLANCE

K. Section 31 20 00 - EARTH MOVING.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

G. RCDD: Registered Communications Distribution Designer.

H. olid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

J. UTP: Unshielded twisted pair.

1.04 QUALITY ASSURANCE

A. See section 28 05 00, Paragraph 1.4.

1.05 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

B. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
   1. Manufacturer's Literature and Data: Showing each cable type and rating.
   2. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
      a. Vertical and horizontal offsets and transitions.
      b. Clearances for access above and to side of cable trays.
      c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
      d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
      e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and
   3. Wiring Diagrams. Show typical wiring schematics including the following:
      a. Workstation outlets, jacks, and jack assemblies.
      b. Patch cords.
      c. Patch panels.
   4. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
   5. Project planning documents as specified in Part 3.
   6. Maintenance Data: For wire and cable to include in maintenance manuals.

1.06 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.

B. American Society of Testing Material (ASTM):
   D2301-04 Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

C. Federal Specifications (Fed. Spec.):
   A-A-59544-08 Cable and Wire, Electrical (Power, Fixed Installation)

D. National Fire Protection Association (NFPA):
   70-11 National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
   44-05 Thermoset-Insulated Wires and Cables
   83-08 Thermoplastic-Insulated Wires and Cables
   467-07 Electrical Grounding and Bonding Equipment
   486A-03 Wire Connectors and Soldering Lugs for Use with Copper Conductors
   486C-04 Splicing Wire Connectors
   486D-05 Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
   486E-00 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
   493-07 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
   514B-04 Fittings for Cable and Conduit
   1479-03 Fire Tests of Through-Penetration Fire Stops

1.07 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use OTDR Optical Time Domain Reflectometer.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 GENERAL

A. Support of Open Cabling: NRTL labeled for support of Category 5e, Category 6, and Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars and spools.
   3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electrical Systems."
   1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

C. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry". Each piece of plywood backing shall be painted white with flame retardant paint and the fire retardant rating label not painted over

2.02 UTP CABLE

A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA/EIA-568-B.1 for performance specifications.
   3. Comply with TIA/EIA-568-B.2, Category 5e, Category 6, and Category 6A.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
      b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
      c. Communications, Riser Rated: Type CMR ; or MPP, CMP, or MPR, complying with UL 1666.
      d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
      e. Multipurpose: Type MP or MPG ; or MPP or MPR.
      f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
      g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.03 UTP CABLE HARDWARE

A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

B. Connecting Blocks: 110-style for Category 5e, 110-style for Category 6, and 110-style for Category 6A. Provide blocks for the number of cables terminated on the block, plus 10 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.04 OPTICAL FIBER CABLE

A. Description: Multimode, 50/125-micrometer, 12 -fiber, tight buffer or loose tube, optical fiber cable.
   1. Comply with ICEA S-83-596 for mechanical properties.
   2. Comply with TIA/EIA-568-B.3 for performance specifications.
   3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
      a. General Purpose, Nonconductive: Type OFNR, OFNP.
      b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
      c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
      d. General Purpose, Conductive: Type OFCR or OFCP.
      e. Plenum Rated, Conductive: Type OFCP complying with NFPA 262.
      f. Riser Rated, Conductive: Type OFCR or OFCP, complying with UL 1666.
   4. Conductive cable shall be aluminum armored type.
   5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
   6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

B. Jacket:
   1. Jacket Color:
      a. Aqua for OM3/OM4 50/125-micrometer cable.
      b. Yellow for OS1/OS2 9/125-micrometer cable
   2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
   3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.05 OPTICAL FIBER CABLE HARDWARE

A. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
   1. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss shall be not more than 0.75 dB.
   2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

B. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

C. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.06 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.07 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

2.08 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.09 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with TIA/EIA-568-B.1.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
   5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
   7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
   9. Pulling Cable:
      a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
      b. Comply with manufacturers published storage and installation temperature ratings.
      c. Store cable in a temperature controlled environment for a minimum of 48 hours prior to installation.
      d. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
      e. Use ropes made of nonmetallic material for pulling feeders.
      f. Pull in multiple cables together in a single conduit.

C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
   1. Splices and terminations shall be mechanically and electrically secure.

2. Where the end user determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the end user.

D. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.

F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

J. UTP Cable Installation:
   1. Comply with TIA/EIA-568-B.2.
   2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

K. Optical Fiber Cable Installation:
   1. Comply with TIA/EIA-568-B.3.
   2. Cable shall be terminated on connecting hardware that is wall, rack, or cabinet mounted.

L. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 4feet apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

M. Installation of Cable Routed Exposed under Raised Floors:
   1. Install plenum-rated cable only.
   2. Install cabling after the flooring system has been installed in raised floor areas.
   3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.

N. Outdoor Coaxial Cable Installation:
   1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors to keep out moisture.
   2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

O. Separation from EMI Sources:
   1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.02 CONTROL CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:
   1. Class 1 remote-control and signal circuits, No. 14 AWG.
   2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.03 CONNECTIONS

A. Comply with requirements in Division 28 Section, PHYSICAL ACCESS CONTROL for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "INTRUSION DETECTION" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.

D. Comply with requirements in Division 28 Section "ELECTRONIC PERSONAL PROTECTION SYSTEMS" for connecting, terminating, and identifying wires and cables.

E. Comply with requirements in Division 28 Section "FIRE DETECTION AND ALARM" for connecting, terminating, and identifying wires and cables.

3.04 FIRESTOPPING

A. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.05 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

3.06 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Install a permanent wire marker on each wire at each termination.

C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

D. Wire markers shall retain their markings after cleaning.

E. In each handhole, install embossed brass tags to identify the system served and function.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
   4. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   5. Optical Fiber Cable Tests:
      a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
      b. Link End-to-End Attenuation Tests:
         1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
         2) Singlemode Link Measurements: Test at 1310 and 1550 nm in 1 direction according to TIA/EIA-526-7-A, Method B One Reference Jumper.
         3) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.08 EXISITNG WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

- - - E N D - - -

END OF SECTION

SECTION 28 05 26
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.

B. “Grounding electrode system” refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning

1.02 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.

C. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.

D. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning.

1.03 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

B. Shop Drawings:
   1. Clearly present enough information to determine compliance with drawings and specifications.
   2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

1.04 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):
   B1-07 Standard Specification for Hard-Drawn Copper Wire
   B3-07 Standard Specification for Soft or Annealed Copper Wire
   B8-04 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
   C2-07 National Electrical Safety Code

D. National Fire Protection Association (NFPA):

   70-11 National Electrical Code (NEC)

   99-2005 Health Care Facilities

A. Underwriters Laboratories, Inc. (UL):
   44-05 Thermoset-Insulated Wires and Cables

83-08 Thermoplastic-Insulated Wires and Cables
467-07 Grounding and Bonding Equipment
486A-486B-03 Wire Connectors

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 0.24 inch² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 0.98 inch² (4 AWG) and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 0.24 inch² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

2.02 GROUND RODS

A. Copper clad steel, 0.75 inch diameter by 3000 mm 10 feet long, conforming to UL 467.

B. Quantity of rods shall be as required to obtain the specified ground resistance.

2.03 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).2.4 ground connections

B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

C. Below Grade: Exothermic-welded type connectors.

D. Above Grade:
   1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
   2. Connection to Building Steel: Exothermic-welded type connectors.
   3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
   4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
   5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
      a. Pipe Connectors: Clamp type, sized for pipe.
   6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.04 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of thick by (3/8 inch x ¾ inch).

2.05 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.06 SPLICE CASE GROUND ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

2.07 COMPUTER ROOM GROUND

A. Provide (1/0 AWG) bare copper grounding conductors bolted at mesh intersections to form an equipotential grounding grid. The equipotential grounding grid shall form a (24 inch) mesh pattern. The grid shall be bonded to each of the access floor pedestals.

2.08 SECURITY CONTROL ROOM GROUND

A. Provide 50mm2 (1/0 AWG) stranded copper grounding conductor(s) color coded with a green jacket, bolted at the Room's Communications System Grounding Electrode Cooper Plate and circulate to each equipment rack ground buss bar through the wire management system. Connect each equipment rack, wire management system's cable tray, ladder, etc. to the circulating ground wire with a minimum 25mm2 (4AWG) stranded Cooper Wire, color coded with a green jacket.
   1. Connect each equipment rack ground buss bar to the circulating ground wire a indicated in 2.9.A, and
   2. Connect each additional room item to the circulating ground wire as indicated in 2.9.A.

PART 3 - EXECUTION

3.01 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.02 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.03 CORROSION INHIBITORS

A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.04 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.05 COMPUTER ROOM/SECURITY EQUIPMENT ROOM GROUNDING

A. Conduit: Ground and bond metallic conduit systems as follows:
   1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 6AWG) bonding jumpers.
   2. Bond at all intermediate metallic enclosures and across all joints using (6 AWG) bonding jumpers.

3.06 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:
   1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
   2. Install insulated (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every (50 feet).
   3. Use insulated (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.

4. Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.07 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to earth ground externally to the building. Under no condition shall the electrical system's third of fourth ground electrode system, or the telecommunications system circulating ground system be connected to the lightning protection system. The Facility's structural steel may be used to connected the lightning protection system at the direction of the Resident Engineer certified by an independent certified grounding contractor.

B. EXTERIOR LIGHT/camera POLES

3.08 EXTERIOR LIGHT/CAMERA POLES

A. Provide 20 ft of No. 4 bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.09 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the end user. Final tests shall ensure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Services at power company interface points shall comply with the power company ground resistance requirements.

3.10 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.

B.

C. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

D. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.11 GROUNDING FOR RF/EMI CONTROL

A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 100 mm (4 inches) wide copper strip or two 6 mm² (10 AWG) copper conductors spaced minimum 100 mm (4 inches) apart. Use 16 mm² (6 AWG) copper where exposed and subject to damage.

B. Comply with the following when shielded cable is used for data circuits.
   1. Shields shall be continuous throughout each circuit.
   2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
   3. Do not connect shields from different circuits together.
   4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.//

3.12 LABELING

A. A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
   1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
   1. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).
   2. Manhole Grounds: 10 ohms.

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

- - - E N D - - -

END OF SECTION

SECTION 28 05 28.33
CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.02 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 06 10 00 - ROUGH CARPENTRY. Requirements for mounting board for communication closets.

C. Section 07 84 00 - FIRESTOPPING. Requirements for sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 60 00 - FLASHING AND SHEET METAL. Requirements for fabrications for the deflection of water away from the building envelope at penetrations.

E. Section 07 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

F. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.

G. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.

H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

I. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.

J. Section 31 20 00 - EARTH MOVING. For bedding of conduits.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

1.04 QUALITY ASSURANCE

A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

1.05 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:

B. Shop Drawings:
   1. Size and location of main feeders;
   2. Size and location of panels and pull boxes
   3. Layout of required conduit penetrations through structural elements.
   4. The specific item proposed and its area of application shall be identified on the catalog cuts.

C. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

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

E. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. Handholes and boxes for underground wiring, including the following:
      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

F. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

G. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Source quality-control test reports.

1.06 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Electrical Manufacturers Association (NEMA):

TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

C. National Fire Protection Association (NFPA):

70-11 National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

1-05 Flexible Metal Conduit

5-04 Surface Metal Raceway and Fittings

6-07 Rigid Metal Conduit

50-07 Enclosures for Electrical Equipment

360-09 Liquid-Tight Flexible Steel Conduit

467-07 Grounding and Bonding Equipment

514A-04 Metallic Outlet Boxes

514B-04 Fittings for Cable and Conduit

514C-02 Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-05 Schedule 40 and 80 Rigid PVC Conduit

651A-07 Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07 Electrical Metallic Tubing

1242-06 Intermediate Metal Conduit

PART 2 - PRODUCTS

2.01 GENERAL

A. Conduit Size: In accordance with the NEC, but not less than 20 mm 3/4 inch unless otherwise shown.

2.02 CONDUIT

A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

B. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.

C. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

D. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 4 inches and shall be permitted only with cable rated 600 volts or less.

E. Flexible galvanized steel conduit: Shall Conform to UL 1.

F. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

G. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

2.03 WIREWAYS AND RACEWAYS

A. Surface metal raceway: Shall Conform to UL 5.

2.04 CONDUIT FITTINGS

A. Rigid steel and IMC conduit fittings:
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB 1.
   2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

B. Rigid aluminum conduit fittings:
1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
2. Locknuts and bushings: As specified for rigid steel and IMC conduit.
3. Set screw fittings: Not permitted for use with aluminum conduit.

C. Electrical metallic tubing fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB 1.
2. Only steel or malleable iron materials are acceptable.
3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2 inches and smaller. Use set screw type couplings with four set screws each for conduit sizes over(2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
4. Indent type connectors or couplings are prohibited.
5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

D. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Clamp type, with insulated throat.

E. Liquid-tight flexible metal conduit fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB 1.
2. Only steel or malleable iron materials are acceptable.
3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

F. Direct burial plastic conduit fittings:
1. Fittings shall meet the requirements of UL 514C and NEMA TC 3.
2. As recommended by the conduit manufacturer.

G. Surface metal raceway fittings: As recommended by the raceway manufacturer.

H. Expansion and deflection couplings:
1. Conform to UL 467 and UL 514B.
2. Accommodate,0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.05 CONDUIT SUPPORTS

A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

C. Multiple conduit (trapeze) hangers: Not less than 1.5 inch by (1-1/2 by 1-1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than (3/8 inch) diameter steel hanger rods.

D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.06 OUTLET, JUNCTION, AND PULL BOXES

A. UL 50 and UL 514A.

B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

E. Sheet metal boxes: Galvanized steel, except where otherwise shown.

F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

2.07 CABINETS

A. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

B. Hinged door in front cover with flush latch and concealed hinge.

C. Key latch to match panelboards.

D. Metal barriers to separate wiring of different systems and voltage.

E. Accessory feet where required for freestanding equipment.

2.08 WIREWAYS

A. A. Equip with hinged covers, except where removable covers are shown.

2.09 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inches wide tape non-detectable type, red with black letters, and imprinted with “CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW”.

2.10 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
   1. Color of Frame and Cover: Gray.
   2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, as indicated for each service.
   6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handholes 11.81 inch wide by 23.62 inch long 2 inches wide by 24 inches long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.11 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

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

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 84 00 "FIRESTOPPING."

2.12 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Plastic. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.13 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. WIRELINE DATA TRANSMISSION MEDIA FOR SECURITY SYSTEMS//

PART 3 - EXECUTION

3.01 PENETRATIONS

A. Cutting or Holes:

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, “JOINT SEALANTS”.

3.02 INSTALLATION, GENERAL

A. Install conduit as follows:
   1. In complete runs before pulling in cables or wires.
   2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
   3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
   4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
   5. Mechanically continuous.
   6. Independently support conduit at 8 foot on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
   7. Support within 12 inches of changes of direction, and within (12 inches) of each enclosure to which connected.
   8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
   9. Conduit installations under fume and vent hoods are prohibited.
   10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
   11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, “FLASHING AND SHEET METAL”.

12. Do not use aluminum conduits in wet locations.
13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:
1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown.

D. Fire Alarm:
1. Fire alarm conduit shall be painted red (a red “top-coated” conduit from the conduit manufacturer may be used in lieu of painted conduit) in accordance with the requirements of Section 28 31 00, “FIRE DETECTION AND ALARM”.

3.03 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Installation of conduit in concrete that is less than 3 inch thick is prohibited.
a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
c. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4 inch of concrete around the conduits.
4. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:
1. Conduit for conductors above 600 volts:
a. Rigid steel or rigid aluminum.
b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximu 6 feet of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

3.04 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors 600 volts and below:
1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over 94.49 inch intervals.

F. Surface metal raceways: Use only where shown.

G. Painting:
   1. Paint exposed conduit as specified in Section09 91 00, “PAINTING”.
   2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, “PAINTING” for preparation, paint type, and exact color. In addition, paint legends, using 1.97 inch high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm 20 foot intervals in between.

3.05 EXPANSION JOINTS

A. Conduits 3 inches and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 3 inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for (15 inches) and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.06 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 8 foot on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:
   1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
   2. Existing Construction:
      a. Steel expansion anchors not less than 1/4 inch bolt size and not less than (1-1/8 inch) embedment.
      b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than (3 inches).
      c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.07 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes).

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by (2-1/8 inches) deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.08 ELECTRONIC SAFETY AND SECURITY CONDUIT

A. Install the electronic safety and security raceway system as shown on drawings.

B. Minimum conduit size of 3/4", but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 3.94 inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 3 inches below the floor and not less than (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
¾	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)

3-1/2	900 (36)
4	1125 (45)

J. Furnish and install 3/4 inch thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 11.81 inch above the finished floor.

K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

3.09 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – “COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS” for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00, “COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS” and related sections for contractor responsibilities for system commissioning.

- - - E N D - - -

SECTION 28 08 00
COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 28.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.02 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.03 SUMMARY

A. This Section includes requirements for commissioning the Facility electronic safety and security systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.04 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.05 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 28 is part of the construction process. Documentation and testing of these systems, as well as training of the end user's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 28, is required in cooperation with the end user and the Commissioning Agent.

B. The Facility exterior closure systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.06 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the end user prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION INSPECTIONS

A. Commissioning of Electronic Safety and Security systems will require inspection of individual elements of the electronic safety and security systems throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00

and the Commissioning plan to schedule electronic safety and security systems inspections as required to support the Commissioning Process.

3.02 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the end user and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.03 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 28 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.04 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

----- END -----

END OF SECTION

SECTION 28 20 00
VIDEO SURVEILLANCE - AXIS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Network (IP) cameras.

B. Video management software.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 303 - Standard for Installing and Maintaining Video Surveillance System; 2025.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts.
   2. Coordinate work to provide power for cameras and equipment at required locations.
   3. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:
   1. Conduct meeting with facility representative to review camera and equipment locations and camera field of view objectives.
   2. Conduct meeting with facility representative and other related equipment manufacturers to discuss video surveillance system interface requirements.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Installer's qualification statement.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Field quality control test reports.

G. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

I. Executed warranty.

J. Specimen warranty.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. Applicable TIA/EIA standards.

B. Maintain at project site one copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing work of this section with minimum three years documented experience with video surveillance systems of similar size, type, and complexity; authorized manufacturer's representative.

E. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 303.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer warranty equivalent to basis of design products covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Axis Communications; www.axis.com/#sle.

2.02 NETWORK (IP) CAMERAS

A. Provide cameras and associated accessories suitable for operation under service conditions at installed location. Provide additional components (e.g., enclosures, heaters, and blowers) as required.

B. Where not factory installed, provide additional components (e.g., lenses and mounting accessories) as necessary for complete installation.

C. Network (IP) Fixed Dome 180 Degree Multisensor Panoramic Camera - Basis of Design: Axis Communications Q38 Series; Model Q3839-PVE (Outdoor, Vandal-resistant); www.axis.com/#sle.
   1. Maximum Video Resolution: 7552 x 3776.
   2. Maximum Frame Rate: 30 fps at 50/60 Hz.
   3. Image Sensor Size: 1 x 1.8 inch.
   4. Minimum Illumination/Light Sensitivity (Color): 0.1 lux.

5. Lens: 4.6 mm, F1.8; horizontal field of view of 180 degrees.
6. Features: Zipstream, forensic capture wide dynamic range, Lightfinder, local storage, Power over Ethernet (PoE), day and night functionality, IP66/IP67/NEMA 4X/IK10 casing.

2.03 VIDEO MANAGEMENT SOFTWARE

A. Unless otherwise indicated, provide all software and licenses required for fully operational system.

B. Video Management System - Basis of Design: AXIS Camera Station Pro; www.axis.com/#sle.
   1. Capacity: Supports unlimited number of cameras, servers, and clients; up to 4 monitors per graphics card.
   2. Recording: Supports continuous, schedule, and event recording modes.
   3. Video Search: Supports search by camera, date, and timeline; smart search, video scrubbing, and locking of priorizted recordings.
   4. Features: H.264, H.265, MPEG-4, and Motion JPEG compression; dewarp support; PTZ control support; remote and mobile access via AXIS Camera Station Pro app; access control and cardholder management; object analytics.

2.04 ACCESSORIES

A. Camera Enclosures and Mounting Brackets:
   1. Where not factory installed, provide accessory camera enclosures suitable for operation under service conditions at installed location.
   2. Where not factory installed, provide accessory camera mounting brackets necessary for installation.

B. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.

C. Provide cables as indicated or as required for connections between system components.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of system components.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.

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

C. Provide required support and attachment; see Section 26 05 29.

D. Wiring Method for NFPA 70 Class 2 and Class 3 Circuits: Unless otherwise indicated, use cables (not in conduit), where permitted by code.
   1. Use suitable listed cables in wet locations, including underground raceways.
   2. Use suitable listed cables for vertical riser applications.
   3. Use listed plenum rated cables in spaces used for environmental air.
   4. Install wiring in conduit for the following:
      a. Where required for rough-in.
      b. Where required by authorities having jurisdiction.
      c. Where exposed to damage.
      d. Where installed outside the building.
      e. For exposed connections from outlet boxes to cameras.

5. Conceal cables unless specifically indicated to be exposed.
6. Route exposed cables parallel or perpendicular to building structural members and surfaces.

E. Provide grounding and bonding; see Section 26 05 26.

F. Identify system wiring and components; see Section 26 05 53.

3.03 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 31 00 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:

1. Site grading, excavation, trenching, embankment, fill and backfill material, placement, and stabilization of areas.
2. Importing required materials.
3. Removing and disposing materials from the site that are not approved for use, or are in excess of that required.
4. Moisture conditioning.
5. Stockpiling and protection of materials.
6. Coordination of utility Earthwork operations with the site Earthwork operation and other Work of the Project.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Authority Having Jurisdiction. For this project the AHJ includes permitting agencies including but not limited to City of Sea Tac, King County, Washington State Department of Ecology.
WSDOT	Washington Department of Transportation Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, 2026 edition.
WISHA	Washington Industrial Safety and Health Act. Revised Code of Washington (RCW) Chapter 49.17
WAC 296-155	Washington Administrative Code (WAC) 296-155 Standards for Construction Work
RCW 39.04.180	Public Works/Trench Excavations – Safety Systems Required

1.3 SUBMITTALS

A. Submit the following documents in accordance with submittal procedures noted in Division 01:

1. Gradation and moisture-density relation test results for each type of fill and backfill material at least 10 working days prior to their delivery at the site. Test results shall demonstrate that materials meet the criteria defined in Part 2 of this Section.
2. Samples of materials proposed for use as fill or backfill and the source location of each material.
3. Field compaction test results per paragraph 1.5.

1.4 NOTIFICATIONS

A. Notify the Inspector five working days in advance of delivering fill and/or backfill materials to the site.

1.5 QUALITY ASSURANCE

A. Testing:

1. Contractor shall provide their own testing service to confirm compliance with Specifications and provide measures for confirming Quality Control.
2. The Owner may take samples and perform moisture content, gradation, compaction and density tests during placement of backfill materials to check compliance with these Specifications. Contractor shall coordinate with Owner's Representative on schedule of Work and timing of testing.
3. The Contractor shall remove surface material at locations designated by the Owner's Representative and provide such assistance as necessary for sampling and testing.
4. The Owner's Representative may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these Specifications.
5. Testing by the Owner's Representative does not relieve the Contractor of responsibility to determine, to Contractor's own satisfaction, when and if Contractor's Work meets the Specification.
6. Test requests may be made by the Owner's Representative for the following items:

    a. Moisture content: ASTM D 2216
    b. Gradation: ASTM D422 and ASTM C136
    c. Density in-place and moisture content: ASTM D2922 and ASTM D3017
    d. Moisture-density relationships: ASTM D1557, every 2,000 cy, or when material changes, whichever occurs first.

2. The minimum amount of testing to be performed and submitted by the Contractor, unless determined otherwise by the Owner's Representative, shall be as follows:

Item	Frequency of Tests
Utility Trenches	One density test per 200 cubic yards of backfill, OR one test for each lift of backfill for each 200 hundred lineal feet of utility trench, which ever results in the greater number of tests.
Backfilling and Paved Areas	One density test in every three hundred cubic yards of fill or backfill, OR one test for each lift of compacted fill over 1,000 square feet of compacted fill or backfill surface, which ever results in the greater number of tests. Compaction tests are required to be performed the same day that the compaction effort is performed regardless of the volume or area of material. This minimum amount of testing does not relieve the Contractor of responsibility to determine, to Contractor's own satisfaction, when and if Contractor's Work meets the Specifications.

3. Special Inspections of soils shall be performed per Structural Drawings, including inspecting materials below shallow foundations to achieve the required bearing capacity; verify that excavations are extended to proper depth and have reached proper material; perform classification and testing of compacted fill materials; verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill; and prior to placement of compacted fill, observe subgrade and verify that the site has been prepared properly.
4. The frequency of tests shown above shall govern the actual quantity of tests. Any re-testing that is required due to failure of initial test to show compliance with these Contract Documents shall be provided and paid for at the Contractor's sole expense.
5. Contractor shall submit reports (three copies) conducted by an independent firm to the Owner's Representative indicating observations and results of the tests, and indicating compliance or non-compliance with Contract Documents.
6. Coordinate testing requirements and scheduling with the Owner's Representative, and assist independent testing firm during field testing and sampling at no additional cost to Owner.

1.2 DIMENSIONS AND LAYOUTS

A. Contractor shall provide all dimensioning and layout required for construction.

B. Furnish, set and mark line and location stakes, including offsets and general construction staking. There shall be onsite at all times when Work requiring control is being performed, necessary equipment, supplies and instruments related thereto. A qualified layout engineer, professional Washington State licensed Land Surveyor, or technical specialist must be assigned to the Contractor's crew for this Work. This equipment and personnel must be available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of Work on the site.

C. Preserve benchmarks and stakes, and replace any that are displaced or missing.

D. Review all utility purveyor, Owner and State records relative to the existing underground utilities. Avoid damage to these facilities and restore utilities at no cost to Owner.

E. Notify Inspector immediately if underground utilities not shown on Plans or Record Documents are encountered.

F. Verify existing location and elevation at connection points of existing utility structures (including pipes) prior to construction of new system. If discrepancies are found, notify Inspector.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Fill:

1. Imported Structural Fill shall conform to WSDOT Section 9-03.14(1) - Gravel Borrow.
2. Common Fill used as Structural Fill shall be native on-site material conform to Common Fill designated in this Section, the grading requirements in WSDOT Section 9.03.14(1) for Gravel Borrow and shall be approved for use by the Owner.

B. Crushed Surfacing:

1. Crushed Surfacing Base Course shall conform to WSDOT Section 9-03.9(3).
2. Crushed Surfacing Top Course shall conform to WSDOT Section 9-03.9(3).

C. Common Fill shall consist of granular and non-granular soil and/or aggregate that is free of deleterious material and does not contain wood, plastic, organic waste, clay, frozen lumps concrete, asphalt or any other deleterious, extraneous or objectionable material. Material shall have a maximum particle size of two inches. Material shall not contain more than 3 percent organic material by weight. On site soils may be suitable for use as Common Fill depending upon weather conditions and moisture conditioning (either drying or wetting) may be required to achieve proper moisture content of compaction. The Owner does not warrant that any of the on-site material can be used as Common Fill. The material shall be capable of being compacted as specified under the weather conditions prevailing at the time of construction. The material shall be within +/- two percent of the optimum moisture as determined by ASTM D1557 test method (modified proctor) prior to compaction. If common fill material is imported then it shall be meet the requirements for borrow in accordance with WSDOT Section 9-03.14(3), Option 1. Confirm with City of Sea Tac Geotechnical Inspector.

1. Fill in non-paved areas shall conform to common fill.

D. Gravel Backfill for Walls and rockeries shall conform to:

1. WSDOT Section 9-03.12(2).

E. Pipe Zone Bedding shall conform to:

1. WSDOT Section 9-03.12(3).

F. Pipe Zone Backfill shall conform to:

1. Trench Backfill shall conform to WSDOT Section 9-03.19, except in landscape areas trench backfill shall be Common Fill, import WSDOT Section 9-03.19 or Structural Fill.
2. Initial backfill for over excavated trenches in wet conditions shall conform to Ballast in accordance with WSDOT Section 9-03.9(1) or Permeable Ballast in accordance with WSDOT Section 9-03.9(2).

G. Conductive Warning Tape: Shall be manufacturer's standard, permanent, brightly colored, continuous printed plastic tape with aluminum backing; intended for burial in pipe backfill; and not less than six inches wide and four mils thick. Tape schedule shall be:

Pipe Type	Color	Wording
Storm Drain	Green	Caution Storm Drain

H. Filter Fabric or Geotextile fabric shall conform to Mirafi 140N or an approved equivalent product.

I. Backfill for demolished items, e.g. fence post foundations, shall be Structural Fill.

J. Landscape Boulders: See Section 32 50 00 - Landscape Boulders.

PART 3 - EXECUTION

3.1 GENERAL

A. Protect existing trees to be saved from damage during construction in accordance with Section 01 56 39 – Tree, Plant, and Soil Protection and this Section.

B. Protect existing structures, areas, utilities and other facilities from damage during construction in accordance with Section 31 10 00 - Site Preparation, including, but not limited to:

1. Verify the presence and locations of existing underground utilities.
2. Notify the Owner's Representative immediately if underground utilities not shown on the Contract Documents are encountered.
3. Repair structures, areas, utilities and other facilities damaged by construction activities to restore them to the condition existing prior to construction as directed by the Inspector and at no additional cost to the Owner.

C. Furnish, set and mark all alignments, line and location stakes, including offsets and other construction staking.

1. Assign a licensed surveyor to complete this work and certify the accuracy of work.
2. Have necessary equipment, supplies and instruments onsite at all times when work requiring control is being performed.

D. Sprinkle water as necessary to control dust during dry weather conditions. Do not use water to extent that could cause flooding, contaminated runoff, excessive moisture content of soil to be reused, or have other adverse effects.

3.2 EXCAVATION

A. Excavate to the lines and grades and at the locations shown on the drawings, including trenches for piping.

1. Conform to elevations and dimensions shown within a tolerance of 0.10-foot.
2. Properly prepare subgrade by removing unstable, soft, weak, or loose debris, clods, and other deleterious materials from excavations to expose firm soil. Replace with compacted Structural Fill unless otherwise specified by the Inspector.
3. Slope and/or shore the sides of excavations and trenches to comply with WISHA, WAC 296-155 and local codes and ordinances having jurisdiction. Maintain sides and slopes of excavations in a safe manner until backfilling is complete.

B. Trench Subgrade Preparation:

1. Grade and smooth bottoms of trenches to provide uniform bearing and support of pipe.

2. Remove rocks and other materials that could cause point loads on the pipes.
3. Form bell holes and depressions sized only as needed to fit the particular type of pipe joint.

C. Catch basins, and similar embedded structures:

1. Excavate a minimum 12 inches between excavation walls and sides of structures and, if prefabricated, four inches below the base of structures to allow for leveling.
2. Remove unsuitable material as described in this Section.
3. Backfill overexcavations in the subgrade with compacted Structural Fill.

D. Dewater as necessary to keep excavations and construction areas in a dry condition. Promptly remove water to prevent softening or disturbance of subgrade surfaces.

E. Where final excavation grades are disturbed by construction activities, overexcavate disturbed material and backfill to grade using compacted Structural Fill at no additional cost to the Owner.

F. Remove and properly dispose of excess excavated material and debris offsite at no additional cost to Owner.

G. Backfill excavations as promptly as construction work allows and after the Owner's Geotechnical Engineer Representative has viewed the prepared subgrade surfaces.

3.3 FILL AND BACKFILL PLACEMENT

A. General:

1. Lightly scarify properly prepared subgrade surfaces that will receive backfill or fill, except for trenches. Moisture-condition the scarified soil to obtain soil moisture near optimum moisture content.
2. Do not place backfill or fill material on surfaces that are soft, muddy, frozen, or containing frost, ice or loose debris or soil.
3. Place backfill and fill in controlled layers of the thickness that is compatible with the type of compaction equipment used.

    a. The loose thickness of each fill or backfill layer shall not exceed 12 inches.
    b. Compact each layer to the minimum relative compaction as listed in this Section.
    c. When placing fill on sloped surfaces, notch fill lifts into subgrade and work thoroughly to destroy interfaces that may otherwise develop.

B. Pipe Zone Bedding:

1. Place and compact pipe bedding in accordance with WSDOT and AHJ to provide uniform support along the entire pipe barrel, without load concentrations at joint collars or bells. Do not use blocking to adjust the pipe to grade except when the pipe is embedded in concrete.

2. Form bell holes and depressions in the bedding only as needed to provide uniform support along the pipe barrel.
3. Take special care to provide uniform and adequate bedding support at pipe connections and adjacent to manholes or other structures to avoid inducing stresses that could damage the pipe or adjacent manhole or other structure.
4. Recompact, or replace and recompact if necessary, bedding that is disturbed or contaminated by removal of temporary shoring, trench boxes or other construction activity at no additional cost to the Owner.

C. Pipe Zone Backfill:

1. Backfill pipe trenches as soon as possible after pipe installation.
    a. Place and compact pipe backfill in accordance with WSDOT Section 7 for the specific type of pipe and conditions.
2. Protect the pipe from damage or shifting alignment during backfill placement.
    a. Do not backfill near catch basins or similar structures until mortar has thoroughly hardened.
    b. Carefully place backfill over the pipe to a depth of two feet above the pipe crown before beginning compaction.
    c. Subsequent lifts shall not exceed 12 inches loose thickness. Each lift shall be compacted with mechanical equipment.
    d. Do not walk on the pipe until the backfill has reached a uniform depth of one-foot above the crown of the pipe.
    e. Pipe damaged during backfill placement shall be replaced at no additional cost to the Owner.
3. Place backfill to achieve the minimum cover thicknesses specified for the type of pipe and conditions in accordance with AHJ.
4. Place conductive warning tape continuously along the alignment of the pipe crown at a depth no less than two feet above the pipe and embedded in backfill at least one-foot below finished grade.
5. Surfacing restoration for utility trenches through existing gravel surfacing to remain shall include an 8-inch compacted depth of crushed surfacing top course.

D. Fill in Tree Critical Root Zones and Soil Protection Areas:

1. Do not use heavy equipment in critical root zones of trees and soil protection areas. Hand compact in CRZ, unless approved in writing by Inspector. See Section 01 56 39 – Tree, Plant, and Soil Protection for additional information on regarding within the CRZ.
2. Place material from equipment that is staged outside of the critical root zone and soil protection area.
3. Rake to grade fill zones in lifts.

E. Moisture Conditioning

1. Shall be performed for fill and backfill materials as needed to meet the compaction requirements specified in this Section. Moisture conditioning includes drying and wetting of fill and backfill materials as needed, and it shall be performed at no additional cost to the Owner.
2. Chemical soil amending such as soil cements, fly ash, lime, etc. shall not be used to adjust moisture condition.
3. Apply water uniformly to soil where subgrade or fill material is moisture conditioned before compaction. Prevent free water from appearing on surface during or subsequent to compaction operations.
4. Remove, replace, scarify or air dry soil material too wet to permit compaction to specified density.
5. Removed soil material that is too wet for compaction may be temporarily stockpiled until removed from site, or spread to allow for drying. However, if material cannot be adequately moisture conditioned, the Contractor shall be responsible for removing material from site at no additional cost to Owner.

F. Compaction:

1. Compact fill and backfill using compaction equipment that can achieve the specified compaction criteria and that is appropriate to the soil type being compacted.
    a. Water settling or jetting is not permitted as a means of compaction.
    b. Around foundation and subgrade drains, compact backfill to a non-yielding condition without damaging the filter fabric or pipe. Repair damaged filter fabric or pipe at no additional cost to the Owner.
    c. Hand compact in CRZ of trees or as approved by the Owner's Arborist.
    d. Within five feet of retaining walls or foundations, use hand-operated equipment to avoid overstressing the walls. Repair or replace walls damaged by improper compaction or other construction activities at no cost to the Owner and as directed by the Owner's Geotechnical Engineer Representative.
2. Compact fill and backfill to a dense and unyielding condition and to the following minimum relative compaction based on the percentage of maximum dry density as determined in accordance with ASTM D 1557, unless otherwise specified.

Locations	Relative Compaction
Pipe bedding	95%
Pipe backfill (non-vehicle areas)	90%
Pipe backfill (in vehicle and/or paved areas)	95%
Under vehicle areas	95%
Under walks	92%
Landscape areas	80-85%*
Gravel Pad for Restroom Building	95%
Other non-structural-bearing areas	90%
Other structural-bearing areas	95%
Rain garden	No compaction

* For landscape areas the relative compaction shall be within the range noted above and not exceed the maximum.

3.4 SOIL STOCKPILES

A. Maintain separate stockpiles for various soil materials. Label each stockpile with weatherproof sign as to material type.

B. Shape and arrange soil stockpiles to promote drainage with a maximum 3:1 slope.

C. Use TESC measures to filter sediment from stormwater runoff from stockpiles and implement flow diversion and energy dissipation measures to safely direct water downstream to TESC treatment system. Runoff from stockpiles shall under no circumstances sheet-flow or direct-flow to existing trees to remain, to adjacent offsite properties, and to new and existing facilities to remain.

D. Cover temporary stockpiles in accordance with Section 01 57 13 – Temporary Erosion and Sediment Control. Material that becomes unsuitable due to lack of protection measures being installed by Contractor shall be hauled and legally disposed of offsite and replaced with suitable material at no additional expense to the Owner.

E. Unsuitable material stockpiles shall be removed, hauled and properly disposed of offsite.

F. See Section 32 91 13 for Soil Preparation of topsoils.

3.5 GRADING

A. Shape surface of site to match contours, grades, spot elevations, profiles and slopes shown on the Contract Documents to a tolerance of 0.05-foot plus or minus over a 10-foot horizontal distance and to maintain positive drainage.

1. Should indicated figures conflict with actual conditions, notify Inspector and obtain direction before proceeding with grading of affected area.
2. In landscaped areas, leave final surfaces rough or scarified to the depth required for topsoil placement. Coordinate with Section 32 91 13 for depth of topsoil and soil preparation requirements.
3. Remove all concrete, rocks, rubble and debris larger than four inches from finished surfaces.
4. Finish grades flush with adjacent surfaces unless otherwise specified.
    a. Adjust finished grades as necessary to provide depth for soil amendments and other components of landscaping, including mulch.
    b. Construct finish grades adjacent to sidewalks to be per Section 32 91 13.
    c. Grade transition areas to provide a smooth surface free of discontinuities.
5. Do not allow grades to exceed maximum slopes in ADA accessible routes and accessible landing areas.

B. Protect finished surfaces.

1. Where finished surfaces are disturbed (e.g. loosened soil, ruts, holes, etc.) by construction activities, over-excavate disturbed material and backfill to final grade at no additional cost to the Owner.
    a. Over excavate to the depth and extent as directed by Inspector.
    b. Backfill with Structural Fill or other material as directed by the Inspector, and in lift thickness and to the compaction criteria established by the Inspector.
2. Repair areas showing settlement at no cost to Owner.
3. Repair areas with any obstructions to positive drainage.

3.6 WET WEATHER PROVISIONS

A. Schedule earthwork operations to minimize the potential for erosion, siltation, and disturbance of site soils.

B. Perform earthwork operations in discrete areas to minimize the exposure of disturbed soils to wet weather.

C. Protect exposed subgrade for utility trenches, structures and paving.

1. Compact exposed soil to reduce the infiltration of rainwater.
2. Implement measures to protect suitable exposed road, paving and structure subgrade from wet and/or rainy weather. If exposed subgrade is left unprotected to wet and/or rainy weather and becomes unsuitable as determined by Inspector, unsuitable material shall be over-excavated and properly hauled and disposed of offsite and replaced with Structural Fill at no additional expense to the Owner.

D. Direct surface water away from fill areas, protected trees, structure, trench excavations, buildings, excavations, adjacent properties and public right-of-way.

E. Protect and cover soil stockpiles with plastic or other measures to prevent infiltration and erosion.

F. Dewater as needed to keep excavations and construction areas free of water.

G. Replace or rework soil that has not been protected in accordance with the requirements of these Contract Documents; and remove and replace, as specified in this Section, soil that becomes too wet for compaction, as directed by the Inspector and at no additional cost to the Owner.

3.7 DISPOSAL OF EARTH MATERIALS

A. Remove all excavated material not acceptable for use as fill onsite. Legally dispose of excess material offsite at Contractor's expense.

END OF SECTION

SECTION 31 10 00
SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:

1. Location of utilities.
2. Clearing, grubbing, stripping and removing and disposing of debris.
3. Protection of existing features and structures, related activities, and other preparatory work.
4. Remove and dispose of materials from site.
5. Remove vegetation, trees and other unwanted materials.
6. Verification of project limits.

1.2 SUBMITTALS

A. Submit the following documents in accordance with submittal procedures noted in Division 01:

1. Copies of Building Sewer, demolition, and other permits associated with earthwork and construction.
2. Dated checklist showing utility service stubs and points of connections have been located and elevations verified.
3. Provide the City with a marked up set of plans documenting locations of demolished utilities, and remaining active utility lines and related appurtenances.

1.3 ACCESS

A. Maintain vehicular and pedestrian traffic routes.

1. Minimize interference with public use of site access roads, tails and paths, adjacent facilities and public roads, streets, alleys, sidewalks.
2. Do not close or obstruct streets, fire lanes, sidewalks, access roads or passageways without permission from Owner and Authorities Having Jurisdiction.

1.4 COORDINATION

A. Protection of existing conditions: Provide, erect, and maintain barricades, coverings and other types of protection measures necessary to prevent damage to existing trees, structures, utilities, landscaping, and other features to remain in place. Restore any improvements damaged by this Work to their original condition or better, as acceptable to the Owner.

B. Contact and coordinate with utility companies and request meter readings, utility cutoffs and meter and line removals. Verify that all appropriate services have been disconnected. Contractor shall pay for all fees and costs associated with utility disconnects, capping, and line and meter removals.

C. Verify existing utility locations and elevations at least 10 working days in advance of construction and demolition.

1. Contact the underground location center to locate and mark utilities not less than four business days, and not more than ten business days before beginning demolition or Earthwork.
2. Compare existing utility locations and elevations with drawings and new utilities.
3. Immediately notify Owner's Representative of potential conflicts to allow for mitigation without down time.

D. Public and private utilities shall remain in service unless otherwise noted on the Contract Documents.

1. Notify underground utility owners at least three working days in advance of excavation and in accordance with RCW Chapter 19.122 and WSDOT Section 1-07.17.
2. Coordinate with utility companies to shut off or cap services that are to be disconnected.
3. Provide schedule of excavation to underground utility owners in accordance with RCW 19.122.
4. Do not shut off or cap utilities without prior notice to Owner's Representative.
5. Pay fees and costs associated with utility disconnects, capping, line and meter removals. Provide temporary bypass and/or temporary services as necessary to minimize interruptions. Do not shut off or cap utilities without prior notice. Keep site utilities in service unless otherwise indicated. Notify Owner and utility providers in writing a minimum of five working days in advance of utility service interruptions. Coordinate with Owner and utility providers.
6. Verify that temporarily shut off utilities are restored.
7. Provide written notification five days in advance of utility service interruptions.

E. Construct temporary erosion and sediment control (TESC) plan in accordance with Section 01 57 13 – Temporary Erosion and Sediment Control. Maintain drains clear and free of debris to allow stormwater to be collected and conveyed.

F. Preserve and maintain benchmarks, control points and stakes, and other reference points, unless otherwise approved by the Owner.

G. Repair and/or restore utilities, benchmarks, stakes and control points and other site structures and features designated as protected or outside construction limits, if damaged by construction activities, at no cost to the Owner and as directed by the Owner's Representative.

H. Objectionable Noises: Limit use of air hammers and other noisy equipment as much as possible. Conform to local governing requirements regarding noise control.

I. Provide (including design and permitting, if required) interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of adjacent facilities and structures to remain. Comply with WISHA, WAC 296-155, and local codes and ordinances having jurisdiction.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Obtain required permits and permission from local governing authorities and Owner prior to commencing Work.

B. Arrange a preconstruction meeting with the Owner and Owner's Representative and notify one week prior of date, time and meeting place location.

C. Before construction and mobilizing to the site, meet with the Owner and review Contract Documents on site.

1. Identify existing trees, utilities, and other site improvements that may be affected by construction.
2. Identify trees, plantings, surfacing, structures and other features to be left undisturbed.
3. Photo documentation of existing trees per Section 01 56 39.

D. Provide, erect and maintain barricades, coverings, flagging or other types of protection necessary to prevent damage to existing structures, areas, utilities, vegetation, and other facilities or features.

1. Restore existing facilities or features damaged by construction activity to their original condition as acceptable to the Owner, including, but not limited to, landscaping, rockeries, walls, pavement, walks, structures, utilities, fences and planters, and at no additional cost to the Owner.

E. Install temporary erosion and sediment control in accordance with Section 01 57 13 - Temporary Erosion and Sediment Control and the Contract Documents.

F. Verify that clearing, grubbing, stripping and demolition and site improvements may safely and appropriately begin.

G. Locate existing utilities within the project limits. Locations of existing utilities shown hereon have been established by field survey or obtained from available records and should therefore be considered approximate only and not necessarily complete. It is the sole responsibility of the Contractor to independently verify the accuracy of all utility locations shown and to further discover and avoid any other utilities not show, which may be affected by the implementation of the proposed improvements.

H. Maintain hauling routes clean and free of debris resulting from Work on this Project.

I. Sprinkle water as necessary to limit dust to the lowest practicable level. Do not use water to such an extent to cause flooding or icing.

J. Properly recycle and dispose of refuse, debris and excess materials resulting from work in accordance with applicable federal, state, and local regulations and requirements. Do not leave these materials on the project site, unless authorized in writing by Owner's Representative.

3.2 TREE, SOIL AND VEGETATION PROTECTION

A. Preserve and protect existing trees and vegetation in accordance with other Sections of the Project Manual and as shown on the Construction Drawings.

3.3 EROSION CONTROL

A. Construct and maintain the TESC system in accordance with Section 01 57 13 Temporary Erosion and Sediment Control, local governing authorities and as conditions dictate.

3.4 CLEARING

A. Remove surface debris, vegetation, underbrush and other deleterious material within areas to be graded, as required for new construction and as indicated. Removal operations shall be performed in a manner to protect property.

1. All trees larger than two-inch caliper designated for removal shall be flagged for approval of Owner's Representative prior to demolition or removal. Notify Owner's Representative at least five business days in advance of scheduled tree removal.
2. Cut stumps and other growth flush with or below original grade surface.
3. Completely remove all growth.

B. Protect all offsite trees along adjacent roadways and on surrounding properties.

C. Clear around trees designated to remain in accordance with soil and vegetation protection requirements specified in Division 01.

3.5 STRIPPING AND GRUBBING

A. In areas to be graded, as required for new construction and as indicated, strip and grub areas to the depth necessary to remove stumps, roots organic material and other deleterious material. Store and stockpile soil materials per Section 31 00 00.

B. Do not strip and grub within soil and vegetation protection areas or areas to remain undisturbed. Coordinate Work with Owner within the Critical Root Zone of trees to remain.

C. Cut any abandoned utility pipes, encountered during construction, back to a minimum of two feet below finished grade and plug with grout.

3.6 SITE IMPROVEMENT REMOVALS

A. Care shall be taken that damage to the existing structures and features, such as but not limited to, utilities, pavement, fences or irrigation lines, which are to remain in place does not occur during the removal of pavement, structure, and other items and features to be removed. All removals are accomplished by making a neat vertical saw cut at the boundaries of the area to be removed. Adjacent materials designated to remain that are damaged by the Contractor due to his or her operations shall be replaced at no additional cost to the Owner.

B. Sprinkle with water excavated material and access roads as necessary to limit dust to lowest practicable level. Do not use water to extent causing flooding, contaminated runoff or icing.

C. Utilities: Cap and remove all piping designated for removal, including underground piping and exposed piping.

1. Piping:

a. Some utility piping and structures are to remain until new services are in operation, and shall be protected during construction. Damage to existing utilities that are to remain shall be repaired at the Contractor's expense.

b. In the event the Contractor encounters utility lines not shown on the drawings, or otherwise indicated to be saved, removed or abandoned, the location of such lines shall be marked in the field and the Owner's Representative notified.

1.2 DRAINAGE

A. Keep street and site drains open for drainage at all times. Mud/sediment build-up shall be removed.

B. Open pits and holes caused as a result of demolition Work shall be kept free of standing water.

1.3 FILLING DEPRESSIONS

A. Fill depressions caused by clearing, grubbing, and utility removal operations with Structural Fill material unless further excavation or Earthwork is indicated. Structural Fill shall be in accordance with Section 31 00 00 - Earthwork.

1.4 DISPOSAL OF MATERIALS

A. The Contractor, in a manner consistent with all government regulations, shall dispose of the refuse resulting from clearing, stripping and grubbing. In no case shall refuse material be left on the Project Site, shoved onto abutting private properties, or be buried in embankments or trenches on the Project Site. Debris shall not be deposited in any stream or body of water, or in any street or alley, or upon any private property except by written consent of the private property owner. Maintain hauling routes clean and free of any debris resulting from Work of this Section.

END OF SECTION

SECTION 31 22 16
PLAYFIELD SUBGRADE ESTABLISHMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, material and equipment for the earthwork related to the subgrade establishment for the synthetic turf athletic field. Work includes but is not limited to the following:

1. Layout and engineering;
2. Surface water and erosion control;
3. Excavation, filling, back filling and compacting;
4. Subgrade scarification, drying, and re-compaction as required;
5. Compaction establishment of subgrade;
6. Coordination of testing for density and planarity and corrective work as directed.

B. Related Sections

31 00 00	Earthwork
31 46 23	Field Permeable Aggregate
33 46 16	Subsurface Drainage

1.2 EXISTING SITE CONDITIONS

A. Refer to drawings for topographical and existing condition information and the geotechnical report for site soil conditions.

B. Carefully maintain benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed. It is the responsibility of the Contractor to familiarize themselves with all records of existing utilities in area of site work.

C. The Contractor shall contact the appropriate utility agencies for identification of underground utility location. The contractor shall contact "CALL BEFORE YOU DIG" service at 1-800-424-5555.

1.3 TEMPORARY EROSION AND SILTATION CONTROL

A. All work shall conform to the Erosion and Sedimentation Control plan requirements including installation of siltation control such as filter fabric fences, check dams, sedimentation basins, etc.

1.4 EXISTING UTILITIES

A. The Contractor shall coordinate all existing utilities prior to proceeding with demolition and earthwork activity. Protect any active pipes encountered; notify Engineer of their existence and record on "as-built" drawings.

B. Should uncharted piping or other utilities be encountered, consult the utility or Owner immediately for instructions.

C. Repair all damaged utilities to the satisfaction of the Engineer. Contact Engineer for determination of responsibility.

1.5 DUST CONTROL

A. Protect persons and property from damage and discomfort caused by dust. Water as necessary to quell dust.

1.6 ROADWAY PROTECTION

A. Provide wheel-cleaning stations to clean wheels and undercarriage of trucks before leaving site, as necessary to prevent dirt from being carried onto public streets. If streets are fouled, they must be cleaned immediately in conformance with City of Everett requirements, as applicable. This requirement applies to all vehicle movements for the entire period of construction.

1.7 TRAFFIC REGULATION

A. Conduct operations in such a manner to avoid unnecessary interference to existing traffic. Minimize heavy vehicle traffic to and from site during peak traffic hours. Do not park vehicles in traffic lanes. Provide flagmen as required. Conform to City of Seattle traffic control requirements.

B. Contractor shall be responsible for all traffic control and emergency call outs resulting from Contractor operations.

C. Maintain fire lanes, roadways and alleys to existing buildings continuously, as required by the fire department having jurisdiction.

D. Existing walkways and roadways leading past the construction shall remain clear and safe at all times. Provide barriers, flashing lights, walkways, guardrails and night lighting as required for safety and control.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FIELD LAYOUT AND ENGINEERING

A. The General Contractor shall be responsible for the vertical and horizontal layout of all work and control points required to construct all work in accordance with the drawings and specifications.

3.2 NOT USED

3.3 SUBGRADE ESTABLISHMENT

A. All areas are to be compacted to 95% of maximum density by mechanical means.

1. The Contractor shall be responsible for maintaining appropriate soil moisture prior to and during compaction activities, the cost of which is to be included in the contract price.
2. If the Contractor finds the subsurface soils to be unsuitable, the Engineer is to be notified immediately.
3. Should extraordinary means become necessary, including amending the soil with fly ash or cement, the contractor will be notified as to the specifics required and shall proceed immediately as so directed. The Contractor shall submit all associated costs for compensation at the agreed rate.

B. Care must be exercised during grading of the subgrade so as to achieve a uniform, true surface relative to finish grade.

C. Fill must be select material to be free of organic matter, clay, concrete and other extraneous material, compactable to a minimum of 95% density. Fill shall be placed within the optimal moisture range and compacted in lifts of 8" maximum loose depth.

D. Finish subgrade for the all field areas shall be compacted to a 95% maximum density. Subgrade shall be established to within the tolerance of +0.00' or - 0.10' of the design subgrade elevation for these areas.

E. Upon completion of the subgrade establishment and Contractor confirmation for conformance with the tolerance, the Contractor shall notify the Engineer and schedule an inspection for approval. The Contractor shall have a laser plane system with slope control available to the Engineer for the inspections. The Contractor shall not be authorized to install the subsurface drainage system lateral lines until the subgrade has been inspected and approved by the Engineer.

END OF SECTION

SECTION 32 11 23.23
SYNTHETIC ATHLETIC FIELD TURF BASE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Description: Provide all labor, materials, and equipment necessary to perform the complete installation of the Synthetic Turf Base.

1.2 RELATED SECTIONS:

Coordinate related work specified in other parts of the Project Manual, including but not limited to following:

Section 31 00 00 - Earthwork
Section 32 17 23.28 – Infilled Synthetic Turf System
Section 33 46 16 – Playfield Subsurface Drainage

1.3 QUALITY ASSURANCE:

A. The Contractor is responsible for verifying the quality of the work and shall perform compaction and density tests on request of the Owner to check compliance with these specifications. A copy of the test reports shall be furnished to the Owner.

B. The Owner's Testing Agency may perform compaction and density tests to check for compliance with these specifications.

C. The Owner may require that an independent testing laboratory test be conducted imported materials at any time. If the material is found to be non-compliant with the Contract, the Contractor shall bear the cost of testing, removal of all non-compliant materials from the site, and replacement of the materials with materials meeting the requirements of the Contract. If the materials tested are found to be compliant with the requirements of the Contract, the Owner will reimburse the Contractor for costs incurred by testing plus mark-ups as allowed for elsewhere in the Contract.

D. It is the responsibility of the Contractor to verify the accuracy of all survey information provided by the Owner prior to commencing excavations or filling operations. Commencement of these operations constitutes acceptance of the survey information as appropriate to meet the intent of the Contract.

E. Submittals: The Owner/Owner's Representative shall approve in principle all products used in the execution of this section prior to their importation to the Project Site. Submit a particle gradation analysis in graph and table form for each product specified. Approval of the Engineer of an analysis does not constitute approval of the actual product, which may be subject to additional testing at any time per paragraph 1.04.C above.

PART 2 - PRODUCTS

2.1 Testing

A. Prior to the importation of any materials, the Contractor shall provide the Owner/Owner's Representative with certified test lab reports indicating properties of each product. The Owner's Representative shall be the final determining factor in establishing compliance with requirements. No material shall be brought onto the job site until the initial analysis has been approved in writing. During importation of materials, the Contractor shall be responsible for continually checking the materials to ensure that they continue to meet the Specifications.

2.2 BASE GEO-TEXTILES:

A. Base Geo-textile shall be a woven, non-biodegradable, highly permeable polypropylene fabric. Fabric shall possess the following properties;

PROPERTY	TEST METHOD	VALUE/UNITS
Grab Tensile	ASTM D4632	200 lbs
Grab Elongation	ASTM D4632	15%
Puncture	ASTM D4833	90 lb.s
Mullen Burst	ASTM D3786	400 psi
Permittivity	ASTM D4491	.07 cm/sec

Base Geo-textile shall be supplied in minimum 15' wide rolls of sufficient length to provide continuous cover of sub-grades receiving base sand with no more than a single interrupting seam or splice. GTF 200S Woven Polypropylene Fabric as manufactured by LINQ Industrial Fabrics, Inc., Somerville, SC (800) 543-9966, or

approved equal.

B. Structural Geo-grid shall be a biaxial polymeric grid as follows (values given are for weakest axis);

PROPERTY	VALUE/UNITS
Initial Modulus	15,170 lbs./ft
Tensile Strength @ 2% Strain	280 lbs./ft
Tensile Strength @ 5% Strain	580 lbs./ft
Junction Efficiency	93%
Junction Strength	MD 98 lb TD 111 lb
Flexural Rigidity	250,000 mg-cm

Product supplied minimum roll width of 4 meters x 50 meters length per roll.

2.3 EDGING: All edges of the Short Pile Synthetic Turf System shall be contained within 2"x 4"x12' (dimensional or nominal) recycled plastic timbers as approved. Recycled plastic materials shall be thoroughly blended and homogenized within the full cross section of any extrusion. Recycled plastic edging shall be secured with grade 60 - #4 (4/8) deformed reinforcing steel.

2.4 FIELD BASE AGGREGATES:

A. General:
1. Provide Aggregates with the specified properties.
2. Provide independent laboratory test results (supplier lab results will not be accepted) identifying performance to the properties specified in the units identified here.
3. Base Course Permeable Aggregate: The Base Coarse Permeable Aggregate shall be fully fractured, highly permeable gradation of aggregates for installation on prepared sub-grade to defined slopes and grades. Provide materials meeting the following property specifications:

a. Material shall contain less than 1/10 of 1% organic material by weight as measured by burn test.
b. All surfaces of individual particles shall be fractured. No worn or naturally occurring faces shall be present.
c. Permeability of a minimum 24" depth, compacted to 95% Proctor, shall be a minimum of 100 inches per hour.
d. Material shall meet or exceed the following sieve analysis:

Sieve Size	Percent Passing
1-1/4" square sieve	100
1” square sieve	90 to 100
¾” square sieve	80 to 100
½” square sieve	50 to 80
3/8” square sieve	40 to 60
No. 4 sieve	20 to 40
No. 8 sieve	15 to 30
No. 30 sieve	5 to 20
No. 100 (wet)	2 to 10
No. 200 (wet)	2 to 6

Modified Type 2 Aggregate, screened to meet the properties described, or Permeable Base Stone from Glacier Northwest, or approved equal.

B. Top Course Permeable Aggregate: The Top Course Permeable Aggregate shall be fully fractured, highly permeable gradation of aggregates for installation on prepared Base Aggregate to defined slopes and grades. Provide materials meeting the following property specifications:

1. Material shall contain less than 1/10 of 1% organic material by weight as measured by burn test.
2. All surfaces of individual particles shall be fractured. No worn or naturally occurring faces shall be present.
3. Permeability of a minimum 12” depth, compacted to 95% Proctor, shall be a minimum of 50 inches per hour.

Sieve Size	Percent Passing
½” square sieve	100
3/8” square sieve	90 to 100
No. 4 sieve	55 to 75
No. 8 sieve	30 to 50
No. 30 sieve	5 to 25
No. 100 (wet)	2 to 10
No. 200 (wet)	2 to 6

Modified Type 1 Aggregate, screened to meet the properties described, or Permeable Top Stone from Glacier Northwest, or approved equal.

PART 3 - EXECUTION

3.1 PROTECTION OF WORK IN PROGRESS:

A. It is the responsibility of the Contractor to protect all work in progress from damage due to extremes of cold, moisture, or drying, or mechanical damage from equipment traffic or foot traffic. Alert the Engineer to the presence or likelihood of conditions that may adversely affect the quality of the work, the physical structure of soils, or transport of site soils off-site

B. Do not work frozen soils.

C. Protect soils from excessive moisture. During periods of prolonged precipitation, take aggressive steps to avoid over-saturation, erosion, or homogenization of soils by covering with protective plastic sheeting, collection and controlled dewatering, detention for sediment removal, and allowing excessively wetted soils to remain fallow until approved by the Engineer as appropriate for continued work.

D. Apply supplemental moisture to overly dry soils.

E. Do not operate heavy equipment near excavations where trench wall or cut-slope failure may result.

3.2 INSPECTION:

A. Prior to commencing the work of this Section, confirm that Section 31 05 16, Geo-textiles have been approved by the Engineer as satisfactorily installed.

B. Protect the approved work as installation of Field Base is commenced and completed.

3.3 EDGING:

A. Prior to commencing installation of edging, perform a utility locate of installed and existing utilities including irrigation, drainage, and electrical. Verify that the installation of the edging will not result in damage to subsurface utilities.

B. Install recycled plastic timber edging in such a manner as to allow the finished Synthetic Turf System to conform to the finish grade lines and elevations as indicated in the Contract Drawings, generally 1/4” below finished grade of adjacent surfaces. Drill each length of timber a minimum of 4 places per timber, beginning 6” from each end and spaced equally a

maximum of 4'-0 on center. The pre-drilled holes shall be sized to ensure that a tight friction bond exists with the anchoring steel, at 3/8" to 1\2" diameter.

3.4 BASE COURSE PERMEABLE AGGREGATE:

A. Do not operate machinery directly on approved Geo-textile installation.

B. Place approved Base Course Permeable Aggregate in a manner that will minimize disturbance to the Geotextile installation. Use only approved transport methods for placement of materials. Thoroughly cover Geo-textile with sufficient Base Course Permeable Aggregate to evenly distribute compressive forces of placement operation.

C. Spread lift of Base Course Permeable Aggregate to the depth specified in the Contract Drawings. Place and mechanically compact in lifts not exceeding 9" at any one time. Perform compaction with a static roller of sufficient weight to ensure proper compaction.

D. Perform testing indicating initial lift of Base Course Permeable Aggregate is at 95% of maximum density.

E. Provide complete compaction to the lines, grades, and slopes indicated on the Contract Drawings. Vertical tolerance for the Base Course Permeable Aggregate installation shall be ½" over 10' as measured from a string line.

3.5 TOP COURSE PERMEABLE AGGREGATE:

A. Place approved Top Course Permeable Aggregate in a manner that will minimize disturbance to the approved Base Course Permeable Aggregate installation. Use only approved transport methods for placement of materials.

B. Spread a single lift of Top Course Permeable Aggregate to the depth specified in the Contract Drawings, allowing for compaction. Perform compaction with a static roller of sufficient weight to ensure proper compaction.

C. Provide complete compaction to the lines, grades, and slopes indicated on the Contract Drawings. Vertical tolerance for the Top Course Permeable Aggregate installation shall be ¼" over 10' from any given point in any direction, as measured with a string line.

D. Coordinate approval of Top Course Permeable Aggregate installation with the requirements of Section 32 18 23.29 - Synthetic Athletic Turf System.

3.6 DISPOSAL OF EXCESS AND WASTE MATERIALS: Remove from the Owner's property all waste materials, including unacceptable materials, trimmings, roll cores, trash and debris, and dispose of it off site in a legal manner. Provide dump receipts from an approved dumpsite.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes pedestrian walking pathways.

B. For vehicular asphalt paving in ROW, see SeaTac Design Standards: https://www.seatacwa.gov/government/city-departments/public-works/pw-engineering/design-standards

1.2 REFERENCES

A. Reference the following standards:

AHJ	Authority Having Jurisdiction. For this project the AHJ includes permitting agencies including but not limited to the City of SeaTac.
WSDOT	Washington Department of Transportation Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, 2026 edition.
King County Standards	King County Roadway Design and Construction Standards, most recent edition

1.3 SUBMITTALS

A. Submit the following information in accordance with Division 01:

1. Documentation verifying mixing plant shall be a member of the Washington Asphalt Pavement Association (WAPA).
2. Certified test results that demonstrate conformance with specifications. Tests shall have been performed within twelve months of anticipated use of materials.

1.4 CORRECTIONS

A. Work corrections include, but are not limited to:

1. Aggregate separation, soft spots, and excess porosity.
2. Cracks, elevation irregularities, and any paving not draining properly

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with Quality Control Section provisions, these Specifications, WAPA, and Manufacturer's recommendations. Where these may be in conflict, the more stringent requirements govern.

B. Materials shall conform to WSDOT Section 5-04.

2.2 CRUSHED SURFACING TOP COURSE

A. Crushed Surfacing Top Course shall conform to WSDOT Section 9-03.9(3).

2.3 GRAVEL BASE

A. Gravel base shall conform to WSDOT Section 9-03.10.

2.4 HOT MIX ASPHALT (HMA)

A. Asphalt concrete shall be HMA Class ½" conforming to WSDOT Section 5-04.

B. Asphalt grade PG 64-22.

2.5 TACK COAT

A. Tack Coat shall conform to WSDOT Section 5-04.3(4).

2.6 CRACK SEALING

A. Crack sealing shall conform to WSDOT Section 5-03.3(3)B.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify site conditions are suitable to receive the work covered in this Section. Do not commence work until conditions are appropriate or corrected. Beginning work constitutes Contractor's acceptance of conditions as satisfactory.

B. Conform to the limits on the plans or as required for utility trenching.

1. Prepare subgrade in all areas to be paved in accordance with Section 31 00 00 - Earthwork, and WSDOT 2-06.
2. Maximum variations in finished grade shall be in accordance with WSDOT 5-04.3(13).
3. Slope all paved surfaces to prevent standing water.

C. Protect surrounding areas, structures, features, and surfaces from damage.

1. Protect work of other trades. Should any defacement or damage occur, repair or replace damaged areas or structures at no cost to the Owner.
2. Where new pavement abuts existing asphalt pavement, sawcut the existing pavement to provide a neat and straight edge at the joint.

3.2 CRUSHED SURFACING COURSES

A. Place crushed surfacing and gravel base in accordance with WSDOT Section 4-04 and compact to a minimum of 95-percent of maximum dry density as determined in accordance with ASTM D1577 and as measured in the field using ASTM D2922.

B. Prior to placing the asphalt concrete pavement, treat the prepared surface in accordance with WSDOT Section 5-05.3(6).

3.3 ASPHALT CONCRETE

A. Spread, finish and compact HMA asphalt concrete in accordance with WSDOT Section 5-04.3(7).

1. Asphalt concrete pavement three inches or thicker shall be placed in layers not exceeding two inches in thickness. Asphalt concrete pavement less than three inches thick may be placed in one layer.
2. Do not pave in rain or when subgrade or base is wet or frozen.
3. Weather limitations for placement of asphalt concrete shall be in accordance with WSDOT Section 5-04.3.

B. Construct joints and connections with existing facilities in accordance with WSDOT Section 5-04.3.

C. Sample and test asphalt concrete in accordance with WSDOT Section 5-04.3.

3.4 TACK COAT

A. Apply tack coat per WSDOT Section 5-04.3. Do not apply tack coats when temperature is below 50 degrees Fahrenheit or when base is wet.

3.5 CLEANING

A. After paving operations, clean surfaces of excess or spilled asphaltic materials.

B. Do not permit equipment or vehicles on asphalt paving until it has cooled and hardened, and in no case sooner than six hours after placing.

END OF SECTION

SECTION 32 13 13
CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to:

1. Concrete pavement.
2. Concrete Mow Strip.
3. Concrete Curb and Gutter.
4. Concrete Curb Ramp.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Authority Having Jurisdiction. For this project the AHJ includes permitting agencies including but not limited Pierce County.
WSDOT	Washington Department of Transportation Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, most recent edition.

1.3 SUBMITTALS

A. Submit the following information in accordance with submittal procedures noted in Division 01.

1. Concrete mix components.
2. Concrete reinforcement.

1.4 RELATED SECTIONS

A. 03 35 33 Exposed Aggregate Concrete Finishing

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II.
2. Fly Ash: ASTM C 618, Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: ASTM C 94/C 94M and potable.

F. Concrete Color for exposed aggregate paving shall be ASTM C979 compliant. Mix in ratios described by the supplier. Supplier shall be either:

1. Concrete Paving Solomon Color shall be #600 Ceramic Dry Integral Concrete Color per https://www.solomoncolors.com/concrete-colors/dry.html, or
2. Approved equal Concrete Color for Exposed

G. Aggregate Paving shall be per section 03 35 23

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes Owner's Representative acceptance of conditions as satisfactory.

B. Verify existing dimensions and shapes. Allow for transitions to existing grades where applicable.

C. Conform to the details, dimensions and grades specified on the Contract Documents.

1. Prepare subgrade in all areas to be paved in accordance with Section 31 00 00 – Earthwork.
2. Maximum allowable slope in ADA area as noted on the plans. The finished slope and cross slope in accessible path of travel and accessible turning areas shall not exceed the maximum allowed by ADA. There is zero tolerance in exceeding maximum allowed - see Construction Drawings.
3. Surface smoothness and maximum variations in finished grade of sidewalks, except accessible path of travel and accessible turning areas shall be in accordance with WSDOT Section 8-14.3.
4. Slope all paved surfaces to prevent standing water.

D. Protect surrounding areas, structures, features, and surfaces from damage.

1. Protect work of other trades. Take special care when work is adjacent to buildings.
2. Should any defacement or damage occur, repair or replace damaged areas or structures at no cost to the Owner.
3. Where new pavement abuts existing concrete or asphalt pavement, replace the concrete at the nearest joint or sawcut the existing pavement to provide a neat and straight edge at the joint as directed by the Owner's Representative.

E. Where existing concrete pavement on a granular base is required to be removed, define the area uniformly in size and shape. Remove the existing concrete by sawcutting pavement vertically at a sufficient distance of at least six inches outside the undisturbed base surface before removing the affected pavement.

3.2 INSTALLATION

A. Prepare subgrade per Section 31 00 00 - Earthwork of this Project Manual.

B. Install concrete pavement in accordance with WSDOT Section 8-14.3 and the Construction Drawings.

1. Provide expansion joints at 10-foot spacing and contraction joints at 5-foot spacing. Coordinate with Owner's Representative for layout of all joints in the field after forms have been built but at a minimum of 48 hours prior to pour.

2. Where shown on plans, finish cement concrete pavement in accordance with WSDOT Section 8-14.3(3). Direction of broom finish shall be perpendicular to the path of travel.
3. Where shown on plans, finish cement concrete pavement with a medium sand blasted finish.

C. Install concrete mow strip and concrete curb and gutter in accordance with WSDOT Section 8-04.3 and the Construction Drawings.

1. Provide expansion joints at 10-foot spacing.
2. Finish concrete mow strip in accordance with WSDOT Section 8-04.3.

D. Install curb ramp in accordance with City of Sea Tac Public Works Standard Dreawings and per Construction Drawings.

1. Finish curb ramp in accordance with WSDOT Section 8-14.3.
2. Direction of broom finish shall be perpendicular to the path of travel.

E. Install exposed aggregate pavement and aggregate topdressing in accordance with specification section 03 35 23. Install aggregate topdressing while concrete is still wet.

3.3 FIELD QUALITY CONTROL

A. Proportion cement concrete to meet the requirement of WSDOT Section 5-05.

3.4 CLEANING

A. Leave premises clean and free of residue of work of this Section in accordance with the requirements of Division 01 of this Project Manual.

END OF SECTION

SECTION 32 17 00
PAVEMENT MARKINGS AND SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:

1. Thermoplastic ADA striping and symbols for parking stalls and access isles.
2. Parking Signs:
    a. R7-8 ADA Accessible Parking and R7-8P (Van Accessible) per MUTCD
    b. R-7 Custom (COE Parks)
    c. R-7 Custom (Access)

B. Traffic Sign Posts

1.2 REFERENCES

A. Reference Standards:

AHJ	Authority Having Jurisdiction. For this project the AHJ includes permitting agencies including but not limited to the City of SeaTac.
WSDOT	Washington Department of Transportation Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, most recent edition.
MUTCD	Manual on Uniform Traffic Control Devices, most recent addition.
WAC	Washington State Codes and Standards (in particular - WAC 51-50 and WAC 51-50-003)
ADA	Americans with Disabilities Act, most recent addition.

1.3 SAMPLING AND TESTING

A. Store materials proposed for use on the project site in sealed and labeled containers, or segregate at source of supply, sufficiently in advance of needs.

1. Clearly identify materials by designated name, specification number, batch number, intended use and quantity formulation number, project contract number, intended use, and quantity involved.
2. At the discretion of the Owner's Representative, material may be approved for use based on the test report, furnished by the Contractor, showing that the proposed batch meets the specified requirements following data.

1.4 SUBMITTALS

A. Submit the following information in accordance with submittal procedures noted in Division 01.

1. Manufacturer's product data, specifications and application instructions for each material with a description of its intended use at the Site.
2. Descriptions of the proposed application methods.

1.5 STORAGE

A. Store materials proposed for use in sealed and labeled containers in accordance with manufacturer's instructions.

1. Clearly identify materials by designated name, specification number, batch number, and intended use.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC ADA STRIPING AND SYMBOLS

A. Thermoplastic pavement markings shall conform to WSDOT Section 9-34.3 – Type A or B Thermoplastic and meet Americans with Disabilities Act (ADA) and MUTCD requirements, including but not limited to dimensions, thickness, color (white), etc.

2.2 PARKING SIGNS

A. Sign materials shall conform to MUTCD sign types and as identified in the Construction Drawings with custom text. Materials and fabrication per WSDOT Section 9-28.

2.3 TRAFFIC SIGN POSTS

A. Sign posts per City of SeaTac Roadway Design Standards: https://www.seatacwa.gov/government/city-departments/public-works/pw-engineering/design-standards

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory by Owner's Representative.

3.2 PREPARATION

A. Thoroughly clean pavement surfaces to be marked before application of the thermoplastic to remove dust, dirt, rubber deposits, surface laitance, and other coatings or deposits.

3.3 PAVEMENT MARKING APPLICATION

A. Apply pavement markings in accordance with WSDOT Section 8-22.

1. Provide guidelines and templates as necessary to control paint application. Sharply outline edges of marking.
2. Apply thermoplastic to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 50 degrees and less than 95 degrees Fahrenheit. Ensure that the Type A thermoplastic material meets the manufacturer's temperature specifications when it contacts the pavement surface.

B. Apply beading to all extruded plastic markings in accordance with WSDOT Section 8-22.3(3)G and manufacturer's instructions.

C. Do not allow traffic or other disturbance in accordance with the manufacturer's recommended timeframe.

1. Correct deficient or disturbed markings as directed by the Owner's Representative at no additional cost to the Owner.

3.4 INSTALLATION

A. Install Signs and Sign Posts per City of SeaTac Roadway Design Standards. Note vertical mounting height minimum of 6' and typically 7' for legibility and ADA guidance.

3.5 CLEANING

A. Remove excess materials and debris and leave premises clean and free of residue in accordance with the requirements of Division 01 of this Project Manual.

END OF SECTION

SECTION 32 17 23.28
INFILLED SYNTHETIC TURF SYSTEM

PART I – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work under this section shall consist of furnishing all labor, materials, and equipment necessary to install, in place, all synthetic turf and other materials as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with these specifications, the turf provider's instructions and in accordance with all details and shop drawings.

1.3 SUBMITTALS

A. Substitutions: Products other than Rootzone 3D3 Blend 52 are acceptable if in compliance with all requirements of these specifications. Submit alternate products with the bid proposal and provide the following:

    1. Provide all specifications, product data, certification and required information for proposed alternate. It is the responsibility of the bidder to prove that the product substitution is equal to or greater than the product specified.
    2. Provide a sample copy of insured warranty and insurance policy information.
    3. Provide a sample (minimum 8.5" x 11") of the product substitution.

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

    1. Submit catalog cuts, material safety data sheets (MSDS), brochures, specifications, preparation and installation instructions and recommendations.
    2. All supplied and installed materials and products will meet or exceed the minimum specifications designated in this section. Sufficient data must be submitted to indicate compliance with the Contract Documents.
    3. Submit instructions for installation.

C. Test Results: The following test results, certified by a licensed independent testing laboratory, shall be submitted as outlined below
    1. With the bid – Mandatory and minimum specifications as shown in Part 2. Bids not

meeting the minimum specifications will be rejected.

2. Upon completion of the installation of the infill (including anti-static applications)—Installer Supervisor must measure and record infill depth using a depth tester for Turf and Tracks with analog or digital readout. At ten separate field locations, three data points should be recorded by measuring the infill depth in a triangular pattern approximately 12" – 18" apart. At each of the ten testing locations, the three data points should be averaged. Any location that does not measure 1.2" in depth or more must be corrected.
3. At completion of project – Dynamic Cushioning Test according to ASTM F-355-95, Procedure A and Standard F-1936-98 only if the finished product is to be used for American Football.

D. Shop Drawings: Show fabrication and installation details for synthetic turf including, but not limited to:
    1. Proposed locations of all seams in fabric surfacing. Show installation methods and construction.
    2. Field lining and marking - Submit a complete scale and dimensional drawing of inlaid or tufted-in field lines and marking boundaries. Include graphics for end zones and center logo artwork for approval as well.
    3. All submittals shall be provided within 14 days after Notice to Proceed

E. The Turf Manufacturer shall provide the following samples of the artificial turf selected for this project
    1. An 8.5" x 11" minimum sample of the exact synthetic turf and infill system that is specified for this project.
    2. Infill mix in accordance with product specifications

F. Turf Manufacturer Certificates: Certified list of fifty (50) existing installations of a synthetic turf and infill system within the last three years, including Owner Representative and telephone number, attesting compliance with quality assurance information. All must be located within the continental United States.

G. With the bid - Proof that the Turf Manufacturer is a member, in good standing, of the Synthetic Turf Council

H. With the bid – Sample Warranty: Provide a sample pre-paid third party insured warranty with the bid. Policy must be in force at the time of the bid.

    1. The Contractor shall provide a warranty to the Owner that covers defects in materials and installation workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf provider must verify that their

representative has inspected the installation and that the work conforms to the turf provider's requirements and any written directives. The warranty shall include general wear and damage caused from UV degradation. Other items that must be addressed include the following:

a. Acceptable uses for the field
b. Fading
c. Color match within specifications
d. Excessive fiber wear
e. Wrinkling and panel movement
f. Shock absorbency (Gmax)
g. Seam integrity
h. Drainage (through the turf only)

2. Exclusions shall include the following:
   a. Vandalism
   b. Acts of God

3. The warranty shall be fully third-party insured for the entire 8-Year term and be non-prorated. Warranties that include language which pro-rates benefits shall cause the provider's bid to be rejected. Prior to final payment for the synthetic turf, the Contractor shall submit to the Owner, this policy guaranteeing the warranty to the Owner. Insurance must reflect the following values:

   a. $5,000,000 per each insured warranty
   b. $5,000,000 annual aggregate for all warranties issued during each 12-month period of the 8-Year warranty
   c. Policies that are backed by a Letter of Credit are not acceptable
   d. Policy must be issued by an A- rated or greater A.M. Best Rating
   e. Policies that include self-insurance or self-retention clauses shall not be considered. Policy can not include any form of deductible amount. Policy must be in force at the time of the bid.

I. With the bid – Turf Manufacturer must attest that their submitted products infringe on no known patents.

J. Maintenance and Operations Data: At the completion and acceptance of the project submit three (3) complete sets, in manual form, of all the turf provider's recommended procedures and materials for, but not limited to general maintenance, line/marking installation, small repair procedures, cleaning, etc...

K. Project Record Documents: Record actual locations of seams, drains, and other pertinent information in accordance with the General Requirements

1.4 QUALITY ASSURANCE

A. Turf Manufacturer Qualifications

1. Shall be experienced in the installation of synthetic infill grass (including in-house factory extruded RootZone® fiber) for a minimum of five (5) years.
2. Shall have a minimum of 500 full sized tall fiber infilled type field installations. Field size to be a minimum of 65,000 square feet to qualify. This list is to be provided with the bid.
3. Shall provide third party certification confirming compliance with referenced standards.
4. Turf Manufacture must formulate and produce its own fiber master batch.

B. Installer Qualifications:

1. Installation team shall be an established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of five years' experience with 15-foot-wide tufted materials.
2. Installation team shall be trained and certified, in writing, by the turf manufacturer, as competent in the installation of the specified material, including seaming and proper installation of the infill mixture.
3. Site superintendent shall have at least 10 installations that are similar to this type of tall fiber synthetic turf system.

C. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified, should be able to withstand full climatic exposure, be resistant to insect infestation, rot, fungus and mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow through drainage allowing free movement of surface run-off through the turf and directly into prepared granular base and into the field drainage system. The synthetic turf and components shall be of national reputation. The turf fabric shall be installed by factory-authorized and certified technicians.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit synthetic turf work to be performed according to Contractor or Turf Provider's written instructions and warranty requirements.

B. Field Measurements: Indicate measurements on Shop Drawings.

1.6 WARRANTY – Special warranty for American Football: Turf must maintain an ASTM F 355 Gmax of less than 165 for the life of the warranty. This is for the entire warranty period of eight (8) years.

1.7 MAINTENANCE SERVICE – Turf Installation Contractor shall train maintenance staff and/or contracted maintenance staff in the use of the recommended maintenance equipment and provide maintenance guidelines to the facility maintenance staff.

PART TWO – PRODUCTS

2.1 ACCEPTABLE TURF MANUFACTURERS

A. Pre-Approved turf manufacturer:

1. AstroTurf Corporation – AstroTurf® Rootzone 3D3 Blend 52
   2680 Abutment Road, SE
   Dalton, GA 30721
   P: 706.277.8873
2. Alternate provider is acceptable and must meet and/or be equivalent to all listed requirements, qualifications, and specifications.

2.2 TURF MATERIALS

A. Synthetic Turf System: A complete synthetic turf system consisting of a combination of 10,800 denier monofilament fibers made from a singularly extruded combination of stabilized polyethylene and nylon polymers with proper compatibilizers and 10,000 denier parallel slit film fibers along with an in-house factory extruded monofilament RootZone®. Pile height shall be nominal 2.0". Fibers shall be tufted to a primary backing and a mechanically applied adhesive secondary backing.

1. The tufted fiber's face weight shall not weigh less than 52 ounces per square yard. The tufted rows of fiber are to be spaced no more than 3/8" apart. ASTM tests proving the fiber meets these qualifications must be provided with the bid. Turf systems that do not meet this specification will be disqualified.
2. The carpet's primary backing shall have a minimum weight of 6.7 oz per square yard. The carpet shall then be coated with a secondary backing of polyurethane synthetic coating material with a minimum application rate of 20 ounces per square yard and then perforated for adequate drainage. Carpets that are not perforated for adequate drainage shall not be acceptable.
3. The carpet shall be delivered in 15' wide rolls. The rolls shall be of sufficient length to go from sideline to sideline. Head seams, other than at sidelines, will not be

acceptable.

B. The infilled pile surface shall provide good traction in all types of weather with the use of conventional sneaker type shoes, composition molded sole athletic shoes, and screw-in style football cleats.

C. The pile surface shall be suitable for both temporary and permanent line markings using acrylic paint, as per the turf provider's recommendations.

D. All adhesives used in bonding the seams shall be resistant to moisture, freeze/thaw, bacteria and fungus attacks, and resistant to ultraviolet radiation. The adhesive shall be made especially for the adhesion of synthetic turf seams and inlaid field markings and graphics.

E. The seam specific adhesive system shall have been utilized on at least 25 full installations. Provide this information with the bid. It shall consist of a factory-made adhesive bed applied to a non-woven fabric seaming tape. The adhesive bed shall be a metered amount suitable for the application. It shall be heat and pressure activated. A special heat application machine and pressure application using weighted rollers is mandatory.

F. Supply field groomer and sweeper or single maintenance apparatus that performs both basic maintenance functions.

G. Perimeter edge details required for the system shall be as detailed and recommended by the turf provider, and as approved by the turf provider.

2.3 TURF FABRIC SURFACE

A. The pile surface shall resemble freshly mown natural grass in appearance, texture and color.

B. The pile surface shall be nominally uniform in length.

C. The pile fiber angle shall be 90 degrees ± 15 degrees, measured from the horizontal after installation of the infill material.

D. The entire system shall be resistant to weather, insects, rot, mildew and fungus growth and

will be non-allergic and non-toxic.

E. The synthetic turf system shall have a nominal fiber length of 2.0”.

F. Each roll shall be minimum 15’ wide

G. The entire system shall be constructed for porous standards as specified. Synthetic turf system shall be perforated at 4 – 6” on center. Systems that are not perforated for maximum drainage shall not be acceptable.

H. All markings shall be tufted in-place, inlaid or glued. It is recommended that the maximum amount of markings be factory-prefabricated into the turf system prior to shipment to site. At a minimum all football markings (with the exception of hash marks) shall be factory prefabricated.

2.4 PRODUCT SPECIFICATIONS – TURF

A. Face yarns shall be a proven athletic quality, outdoor stabilized monofilament made from a singularly extruded combination of stabilized polyethylene and nylon polymers with proper compatibilizers.

B. The fabric shall possess the following minimum physical characteristics. ASTM testing shall be provided with the bid and any products not meeting the minimum physical characteristics will be rejected:

Average Pile Yarn Face Weight	ASTM D 5848	52 oz/square yard
Average Total Weight	ASTM D 5848	78.7 oz/square yard
Secondary Backing Weight	ASTM D 5848	20 oz/square yard
Primary Backing	ASTM D 5848	6.7 oz/square yard
Average Tuft Length	ASTM D 5823	2.0”
Tufting Gauge	ASTM D 5793	3/8” maximum
Tuft Bind	ASTM D 1335	> 8 lbs
Yarn Denier (monofilament fiber)	ASTM D 1577	10,800/6
Yarn Denier (slit film fiber)	ASTM D 1577	10,000/1
Yarn Denier (Rootzone fiber)	ASTM D 1577	5,600/8
Fiber Thickness (Mono/slit-film)	ASTM D 3218	330/115 microns
Surface Flammability	ASTM D 2859	TEST PASSED
Permeability	ASTM F 1551	>30
Melt Point	ASTM D 789	248 degrees Fahrenheit
Gmax System (American Football)	ASTM F 355	<125 at installation < 165 over life of warranty

2.5 INFILL MATERIAL

A. Infill composition shall consist of a ballast layer of silica sand topped by ambient SBR rubber performance infill in a ratio by weight of 65% rubber / 35% sand.

B. Silica sand infill:
    1. Must be clean, sub-angular silica sand
    2. Must be a 20-40 sieve size.

C. SBR infill:
    1. Must be ambient SBR Rubber
    2. Must be a 10-20 sieve size.

D. Immediately after infill layers are installed, infill depth must be measured per testing protocol detailed in Section 1.3 C. 2 above to ensure that infill layer is at least 1.2" deep.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of the synthetic turf, examine substrates and conditions, with Installer present, for compliance with requirements for visual installation tolerances. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Certification of prior work: The synthetic turf manufacturer and / or certified installation contractor shall perform a visual inspection of the field base onto which the synthetic turf system is to be installed and to examine the finished surface for required compaction, and grade tolerances (through string line testing). After any discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of VISUAL acceptance of the base for installation of the synthetic turf system. Any tests other than VISUAL tests (string line, water hose, etc...) shall be the responsibility of the General Contractor, Architect, Engineer, or Sports Field Consultant.

C. Installation of all materials shall be performed in full compliance with approved project shop drawings. Only factory trained and certified technicians skilled in the installation of athletic caliber synthetic turf systems, working under the direct supervision of the turf manufacturer's project managers, shall undertake the placement of the turf system. The designated supervisory personnel on the project must be certified, in writing by the turf provider as competent in the installation of these materials, including proper seaming and proper installation of the infill mixture. The turf provider shall certify the installation and

warranty compliance.

3.2 PREPARATION

A. Inspect delivered field surface fabric and components immediately prior to installation. Any damaged or defective items shall be rejected. Installed synthetic turf system shall be inspected for, but not limited to, the following:
    1. Uniformity of product and color
    2. Surface wrinkles
    3. Field markings
    4. Field Edge installation
    5. Pile height of each roll shall be measured. Any material(s) that does not meet minimum height and thickness specifications shall be rejected. Pile height shall be measured in its finished positions.

B. Environmental Conditions: Weather conditions are important for the successful installation of the systems. No work under this section will proceed when:
    1. Ambient temperatures are below 45 degrees F.
    2. Material temperatures are below 45 degrees F.
    3. Surfaces are wet or damp
    4. Rain is imminent or falling.
    5. Conditions exist or are imminent, which will be unsuitable to installation requirements of the systems specified herein. Humidity levels will be inside the limits recommended by the adhesive manufacturer to obtain optimal bonding characteristics of the surfaces.

3.3 INSTALLATION OF THE SYNTHETIC TURF

A. The full width rolls shall be laid out across the field. When all of the rolls of the playing surface have been installed, the sideline areas will be installed at right angles to the playing field turf. All seam widths are to be held to a minimum and shall be traverse to the field direction. Seams shall be flat, tight, and permanent with no separation or fraying. All seams shall remain as required for the duration of the warranty period.

B. The perimeter of the field shall be firmly secured to the edge anchors for the life of the warranty and in accordance to project details.

C. Resilient Infill
    1. The sand ballast infill material shall be spot inspected and tested for conformance to sieve specifications.
    2. Sand ballast Infill must be placed in such a way as to minimize fiber entrapment.
    3. The rubber infill must be uniformly applied so as to ensure uniform, predictable surface.

4. After infill layers are installed, infill depth must be measured to ensure that infill depth is at least 1.2” deep.

3.4 FIELD LINING AND MARKINGS

A. All markings shall be installed in accordance with prior approved project Shop Drawings.

B. Inlays shall conform to the turf manufacturer’s specifications, directions, and recommendations for the best results.

C. Striping layouts shall be accurately measured by the Contractor before installation of inlaid field markings

D. Install inlays only when the surface is completely dry. Adhere all inlays securely into place. Never loose-lay and sew an inlay into place.

3.5 FIELD QUALITY CONTROL—Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

A. Testing Services: Testing and inspecting of completed applications of synthetic turf system shall take place in suggestive states, in areas of extent and using methods that are industry standard. Do not proceed with application of next stages until test results for previously completed applications show compliance.

B. Remove and replace items where test results indicate that it does not comply with specified requirements.

3.6 FINAL ACCEPTANCE

A. Upon final acceptance, the Manufacturer shall submit to the Owner three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.

B. The Manufacturer shall ensure that the turf can be plowed with Manufacturer approved snow removal equipment as detailed in the provided Maintenance Manuals.

C. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use.

3.7 CLEANING

A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items. All usable remnants of new material shall become the property of the Owner. The Contractor shall keep the area clean throughout the project and clear of debris. Surfaces, recesses, enclosures, etc... shall be cleaned, as necessary, to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

SECTION 32 18 16.13
PLAYGROUND SURFACING TILES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Resilient, interlocking, playground safety surfacing tiles.

1.2 REFERENCES

A. ASTM C 67 – Standard Test Method Methods for Samping and Testing Brick and Structural Clay Tile.

B. ASTM C 501 – Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abrader.

C. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

D. ASTM D 573 – Standard Test Method for Rubber-Deterioration in an Air Oven.

E. ASTM D 624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

F. ASTM D 2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

G. ASTM D 2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

H. ASTM D 3676 – Standard Specification for Rubber Cellular Cushion Used for Carpet or Rug Underlay.

I. ASTM E 303 – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.

J. ASTM F 1292 – Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.

K. US Consumer Product Safety Commission (CPSC) Handbook for Playground Safety.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation and subsurface instructions.

C. Samples: Submit manufacturer's sample of 1 full tile.

D. Test Reports: Submit certified test reports from qualified independent testing agency indicating results of the following tests:

1. Impact Attenuation: ASTM F 1292.
2. Freeze Thaw: ASTM C 67.
3. Rubber Deterioration/Air Oven: ASTM D 573.
4. Slip Resistance: ASTM D 2047 and E 303.
5. Tensile Strength: ASTM D 412.
6. Elongation at Break: ASTM D 412.
7. Tear Strength: ASTM D 624.
8. Peak Load: ASTM D 624.
9. Density: ASTM D 3676.
10. Taber Abrasion: ASTM C 501.
11. Flammability: ASTM D 2859.

E. Certificate of Compliance: Submit manufacturer's certificate of compliance indicating materials comply with specified requirements.

F. Manufacturer's Project References:

1. Submit list of 15 successfully completed projects.
2. Include project name and location, name of architect, and type and quantity of playground safety surfacing tiles furnished.

G. Installer's Project References:

1. Submit copy of manufacturer issued installation certification

H. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.

I. Warranty: Submit manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer shall meet a minimum of 1 of the following 2 requirements.

1. Continuously engaged in manufacturing playground safety surfacing tiles of similar type to that specified, with a minimum of 10 years successful experience.
2. Furnished a minimum of 15,000,000 square feet of playground safety surfacing tiles of similar type to that specified.

B. B. Installer's Qualifications:

1. Certified by manufacturer for installation of playground safety surfacing tiles.
2. Approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:

1. Store materials in accordance with manufacturer's instructions.
2. Playground Safety Surfacing Tiles:
    a. Store tiles in a dry area at a minimum temperature of 50 degrees F (10 degrees C) for a minimum of 72 hours before installation.
    b. Protect tiles from direct sunlight before installation.
3. Adhesive: Store adhesive in a dry area at a minimum temperature of 50 degrees F (10 degrees C).

C. Handling: Protect materials during handling and installation to prevent damage.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Tile Temperature: Ensure surface temperature of playground safety surfacing tiles is a minimum of 50 degrees F (10 degrees C) at time of installation.

B. Air Temperature: Ensure air temperature is a minimum of 40 degrees F (4 degrees C) for a minimum of 24 hours before and during installation.

C. Tile or Air Temperatures: Consult manufacturer's installation instructions for modified installation procedure when tile or air temperatures are above 85 degrees F (29 degrees C).

1.7 WARRANTY

A. Materials and Workmanship: Playground safety surfacing tiles shall be warranted for defects in materials and workmanship for the lifetime of the playground.

B. Performance: duraSAFE Rubber Playground Tiles shall be warranted to meet drop height performance requirements of ASTM F 1292 for the lifetime of the playground.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. sofSURFACES Inc., 4393 Discovery Line, Petrolia, ON Canada N0N 1R0. Toll Free (800) 263-2363. Phone (519) 882-8799. Fax (519) 882-2697 Website: www.sofsurfaces.com. E-mail info@sofsurfaces.com. Or approved equal

2.2 RUBBER PLAYGROUND TILES

A. Tiles: duraSAFE Series

1. Series: Premium.
2. Description: Resilient, interlocking, playground safety surfacing tiles.
3. Compliance: Meet and exceed CPSC guidelines for impact attenuation.
4. Material: Compression-molded, recycled rubber and binding agents.
5. Tile Locking: U-shaped male and female configuration on all 4 sides to lock tiles to adjacent tiles.
6. Top Edges: Chamfered.
7. Tile Bottom: Hollow core stanchion pattern.
8. Wear Layer: Compression molded to obtain optimum density and durability.
    a. Plus Series: Combination of elongated SBR rubber and granulated crumb rubber. Pigmentation used to achieve color. Minimum 0.375 inch thick.
    b. Premium Series: Virgin TPV rubber granules. Minimum 0.250 inch thick.
9. Manufactured Size: 24 1/8” X 24 1/8” Nominal. Installed size: 24” X 24”.
10. Thickness:
    a. Critical Fall Height 8 Feet: 4.25 inches.

11. Minimum Weight Each Tile:

    a. Premium Series:
        1) 2.00-Inch Thickness: 24.00 pounds.
        2) 2.25-Inch Thickness: 25.50 pounds.
        3) 2.75-inch Thickness: 28.50 pounds.
        4) 3.25-Inch Thickness: 30.00 pounds.
        5) 3.75-Inch Thickness: 32.00 pounds.
        6) 4.25-Inch Thickness: 34.00 pounds.
        7) 4.75-Inch Thickness: 36.50 pounds.
        8) 5.00-Inch Thickness: 39.00 pounds
        9) 5.25-Inch Thickness: 40.00 pounds

12. Colors:

    a. Premium Series: Blue Spruce

B. Test Results:

1. Impact Attenuation, ASTM F 1292:

    a. G-Max Score: Less than 125.

    b. Head Injury Criteria (HIC) Score: Less than 700.

2. Freeze Thaw, ASTM C 67: No deterioration.

3. Rubber Deterioration/Air Oven, ASTM D 573: No deterioration.

4. Slip Resistance:

    a. a. ASTM E 303:

        1) Dry: 51 minimum.

        2) Wet: 44 minimum.

    b. ASTM D 2047:

        1) Premium: 0.601.

5. Tensile Strength, ASTM D 412:

    a. Premium Series: .636 Mpa.

6. Elongation at Break, ASTM D 412:

    a. Premium Series 35.3%

7. Tear Strength, ASTM D 624:

    a. Premium Series: 2.4 kNm.

8. Flammability:

a. Burning Pill, ASTM D 2859: Pass.

9. Density, ASTM D 3676:
    a. Premium Series: 859 kg/m3
10. Taber Abrasion, Wear index, ASTM C 501:
    a. Premium Series: 77

2.3 ACCESSORIES

A. Corners:
    1. Prefabricated outside and inside corners.
    2. Material: Same as playground safety surfacing tiles.

B. Ramps:
    1. Prefabricated Ramps: “SofRAMP Jr.”.
    2. Prefabricated ADA-Compliant Ramps: “SofRAMP ADA”.
    3. Material: Same as playground safety surfacing tiles.

C. Adhesive: Furnished by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive playground safety surfacing tiles. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Prepare subsurface in accordance with manufacturer's instructions to ensure proper slope, support and drainage for playground safety surfacing tiles.

B. Field Base Aggregate Subsurface: Compacted, granular aggregate subsurface shall be as specified in Section 32 11 23.

C. Specifier Notes: Include the following paragraph when adhesive will be used between a concrete subsurface and the base of the playground safety surfacing tiles.

D. Concrete Subsurface:
    1. Concrete subsurface shall be as specified in Section 03300 (03 30 00).

2. Apply light broom finish.
3. Ensure concrete is sound with no loose material or cracks over 1/8 inch wide.
4. Ensure concrete is a minimum of 10 days old.
5. Test concrete for moisture in accordance with manufacturer's instructions to ensure it has sufficiently cured and is dry.
6. Power wash existing concrete in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install playground safety surfacing tiles in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Ensure prepared subsurface and tiles are dry and clean.

C. Layout tile surface in accordance with manufacturer's instructions.

D. Apply adhesive in accordance with manufacturer's instructions for tile-to-tile as well as tile-to-base for all keystone and strategic tile rows.

E. Installation to be completed by a factory trained and certified installer.

3.4 FIELD QUALITY CONTROL

A. Installed Surface Performance Test: ASTM F1292

1. Perform impact attenuation testing according to ASTM F1292 in presence of Owner’s representative within 30 days of installation.
    a. Confirm Impact Attenuation Performance of Surfacing Tiles:
        1) g-max Score: Less than 125
        2) 2) Head Injury Criteria (HIC) Score: Less than 700
2. Test Equipment Operator Qualifications:
    a. National Recreation and Parks Association/National Playground Safety Institute (NRPA/NPSI), Certified Playground Safety Inspector (CPSI).
    b. Trained in the proper operation of Triax test equipment by competent agency.
3. Determine compliance with ASTM F 1292, unless otherwise specified in this section.

3.5 CLEANING

A. Remove adhesive spills from playground safety surfacing tiles in accordance with manufacturer's instructions.

B. Clean tiles in accordance with manufacturer's instructions.

3.6 PROTECTION

A. Protect playground safety surfacing tiles from foot traffic for a minimum of 12 hours after installation.

B. Protect completed tiles from damage during construction.

END OF SECTION

SECTION 32 31 13
CHAIN LINK AND SITE FENCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK INCLUDED

A. Furnish all labor, materials, and equipment required to construct black vinyl coated chain link fencing as indicated on the drawings or specified herein. Said work shall include any incidentals required to provide a finished job.

1.2 RELATED SECTIONS

A. 03 30 00 - Cast In Place Concrete

1.3 QUALITY ASSURANCE

A. The Contractor/Installer must be experienced in fence installations. Contractor shall provide photographs and addresses of three representative local fence projects that they have been completed within the last three years for Owner's Representative's review.

B. Contractor shall provide a one-year minimum warranty stating that the fencing is secure and stable, tight, corrosion-free, in proper alignment, complete in detail and finish, and free of hazardous conditions. Any defects that develop within one year from the date of Physical Completion shall be replaced at the expense of the Contractor.

C. Manufacturer shall provide a ten-year materials warranty as described in paragraph 1.7.

D. Thoroughly inspect site(s), related work, and Owner-supplied materials (where applicable). Notify the Owner before bidding of any conditions adversely affecting the performance of fencing installation.

E. Standard Specifications and Standards: All work shall conform to all applicable requirements of the following Standard Specifications, whether specifically referred to or not, except as specifically modified herein.

1. Comply with the requirements of the American Society for Testing and Materials (ASTM) especially the ASTM Committee F-14 Standards on Fences (latest edition).
2. Perform all shop and field welding in accordance with the pertinent recommendations of the American Welding Society.
3. Pipe ASTM A-53 / A53M - 12.
4. ASTM A 392.

5. ASTM F 668-88, Class 2a.
6. ASTM F626-89a.
7. F1043-12 Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
8. F1083-10 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
9. WSDOT Chain Link Fence 8-12.3 and 9-16.1.

1.4 SUBMITTALS

A. The Contractor shall make all product submittals and submit Shop Drawings, for approval, prior to manufacturing, detailing fencing, including typical line post locations, gate locations, and foundation design in accordance with Section 01 33 10 - Submittals.

B. The Contractor shall provide certified letters from manufacturers indicating conformance with specifications, manufacturing date and lot number for all materials used on the site.

C. Warranty sample.

D. Samples: color selection for finishes as specified.

E. Concrete footing mix design per 03 30 00 – Cast in Place Concrete. Not required if already approved for conformance as part of 03 30 00 submittals.

1.5 SUBSTITUTIONS AND PRODUCT OPTIONS

A. During bidding, all bidders shall bid on the specified products.

B. Refer to Division 01 Specifications for Product Substitution requirements.

1.6 PRODUCT HANDLING

A. All materials are to be new and delivered to the site in an undamaged condition. Store materials off the ground and protect from damage. In the event of damage, immediately make repairs and/or replace as necessary to the approval of the Owner's Representative and at no additional cost to the Owner. Owner's Representative shall inspect all materials prior to installation.

1.7 WARRANTY

A. Warranty all materials and products for 10 years from loss of coating, and

B. All labor shall be warrantied for one year from time of substantial completion of the project.

C. Warranty shall be made out to: City of SeaTac Parks and Community Services 4800 S. 188th St., SeaTac, WA 98188 .

PART 2 - PRODUCTS

2.1 STEEL FENCE FRAMING

A. All piping for chain link fence and gates shall be Schedule 40 hot-dipped galvanized steel or approved equal for size, finish, material composition, strength, appearance, performance and ease of maintainability - per ASTM – F1083-12 prior to powder coating of fence posts.

B. Sizing shall be in accordance with ASTM F 668-88. All fence fittings shall comply with ASTM F626-89a.

C. All materials except nuts and bolts shall be PVC or polyolefin elastomer coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10-15 mils (0.254 - 0.38 mm) thermally fused in black color to match fabric.

2.2 CHAIN LINK FENCE FABRIC

A. Color coated chain link fence fabric shall conform to ASTM F668-88 Class 2a material.

B. Fabric shall be W&M Steel Core Wire, or approved equal, galvanized with not less than .30 oz. per square foot of actual surface, with a .015 - .025-inch PVC bonded or powder coating, extruded and adhering to the galvanized wire. Fabric shall be woven in a continuous 2-inch mesh. Steel core wire shall have a minimum breaking strength of 1290 lbs. Finished size, including PVC bonded coating, shall be 8-gauge (finished). Lower edge of fabric shall be no greater than 1-1/2 inches above concrete or finished grade as specified on plans and details.

C. Fabric shall have a knuckled top and bottom selvage.

D. Height of the fabric measured from the ends of the knuckled selvage shall be as specified on plans and details, plus or minus 1 inch per 8 lineal feet.

2.3 CHAIN LINK FENCING FRAMEWORK

A. All posts, rails, and framework shall have 10-15 mils of black matte powder coating. No hand painting is allowed, except for minor touching up. All posts, rails, rods shall be steel pipe. Sizes shall be as specified in the following table:

B. For Color Coated Fencing:

Type	*Dimensions*
Terminal / Corner Posts	*2-3/8" OD*
Line Posts	*1-7/8" OD*
Top Rails	*1-5/8" OD*
Intermediate Rails	*N/A**
Bottom Rails	*N/A**
Post Footing Size for Terminal/Corner Posts	*12" W* *30" D*
Post Footing Size *for Line Posts*	*12" W* *24" D*
Fabric Mesh Size	*2"*
Fabric Finished Size	*8-gauge***

**Intermediate and bottom rails are not required for these sizes of fencing unless it is specified and detailed on a project- by-project basis.*
***8-gauge (finished) with 9-gauge core wire (typical)*

2.4 CHAIN LINK FITTINGS

A. Fittings shall be hot-dipped galvanized pressed steel in accordance with ASTM F 626-89a. All fittings shall be industrial quality. All fittings except nuts and bolts shall be black matte vinyl coated after galvanizing, with 10-15 mils of thermally bonded PVC.

B. After installation, spray all nuts and bolts and non-coated hardware with two coats of flat alkyd enamel paint (color to match fence) suitable for metal.

2.5 CHAIN LINK ACCESSORIES

A. Post tops shall be pressed steel and designed as a weather tight closure cap for tubular posts and shall be vinyl coated. All post caps shall have set screws.

B. Tension bars shall be of one-piece lengths equal to full height of fabric with a minimum cross section of 3/16" x 3/4". Provide two tension bars (vinyl coated) for each end post, corner and pull posts.

C. Tension bar bands (vinyl or powder coated), shall be pressed steel per ASTM F 626-89a spaced not over 12 inches OC to secure tension bars to end, corner, and pull posts.

D. Tension Wire: Contractor shall provide a No. 7 W & M gauge galvanized high carbon coiled, tension wire (vinyl coated), stretched along the bottom of fabric and fastened to the fabric at intervals of not more than 18 inches, using steel hog rings. Tension wire shall be attached with brace band, and nut and bolt. Tension wire shall be terminated around the bolt to itself with a minimum of three complete wraps.

E. Wire Ties: Contractor shall provide wire ties as follows: 8-guage vinyl or powder coated aluminum wire ties (with 9-gauge core wire) on all fencing with 8-guage fabric (with 9-gauge core wire), spaced at 12 inches O.C. (typ.). Tie fabric to tension wire with 9 gauge hog rings at 18 inches O.C. (typ.).

2.6 MISCELLANEOUS CHAIN LINK MATERIALS AND ACCESSORIES

A. Concrete Footings: Refer to this Section for dimensions of all concrete post footings. Concrete for post footings shall conform to WSDOT Section 6-02.3(2)B. Concrete footings shall be neatly and evenly crowned slightly above finished grades and all concrete shall be cleaned from all posts.

2.7 CHAIN LINK PAINT AND PRIMER

A. No hand painting is allowed, except for minor touching up. Any touch up needed shall be completed with Carboline Carbozinc 11, paint on with 2 coats steel posts – contact Carboline Products, St Louis, MO 314-644-1000 – or approved equal.

PART 3 - EXECUTION

3.1 SITE PREPARATION

A. Pre-Installation Conference: At least fourteen (14) days prior to commencement of Work of this Section, schedule an onsite meeting with the Owner's Representative, Contractor and Subcontractor.

B. The Contractor is responsible providing temporary barricades and enclosures, and protection of adjacent property and existing work. Barricades are to be in place before construction operations are started. Coordinate this work with other on-site work and trades. Complete clearing and site preparation work is required prior to excavation.

C. The Contractor shall not allow vinyl coated materials to become scratched, gouged or damaged in any way during the storing or construction of the fence.

3.2 CONCRETE FOOTINGS

A. Contractor to install all concrete footings per the Construction Drawings and per submitted and approved structural footing design.

B. Coordinate fencing footings with placement and pouring of field curbing.

3.3 CHAIN-LINK FENCE CONSTRUCTION

A. Posts:

1. Auger holes for post footings in firm, undisturbed or compacted soil. Holes for new line post footings shall be sized as provided in Contractor's approved shop drawings. Holes for terminal and gateposts shall be sized as provided in Contractor's approved shop drawings
2. Over-excavate footing hole depths to 6 inches deeper than post bottoms.
3. Place concrete around posts in a continuous placement, tamp for consolidation, checking each post for vertical and top alignment. Support posts plumb until concrete has cured. Set and secure keepers, stops, sleeves, and other accessories into concrete as required.
4. Tops of post footings shall be flush with finished grade, troweled and sloped outward to drain. Top of footing shall appear true and circular in shape with post at center of circle.
5. Posts shall be 10 feet O.C. maximum.

B. Sleeved Posts:

1. Insert posts into sleeves provided in concrete footing for tops of walls and hoop-style backstops as specified on plans and details. Check each post for vertical (plumb) and top alignment.
2. Posts shall be 10 feet O.C. maximum.

C. Rails:

1. Top rail shall be securely fastened to terminal posts and pass through tops of line post fittings, forming a continuous rail for the full length of fence. Top rail shall be furnished in lengths approximately 21 feet long with standard hot dip galvanized, vinyl coated steel expansion couplings not less than 6 inches in length. Lengths less than 10 feet shall not be used adjacent to terminal posts. Place top rail and coupling to allow for slip expansion and contraction.
2. Intermediate and bottom (when specified) rails shall conform to the same specifications as the top rail and be joined at line posts with double-end socket clamps or brace bands and rail ends, with one inverted to maintain smooth line.

D. Brace Assemblies: All corner, terminal, and gate posts shall be furnished with complete brace assembly, including brace of same material and finish as top rail, and adjustable tightener for 3/8 inch truss rod. Corner and terminal posts shall have two brace assemblies, one in each direction. The diagonal 3/8 inch adjustable truss rod shall be attached to the first ensuing line post. Install braces so that posts are plumb and true when diagonal rod is under proper tension. No truss rod is required if the intermediate rail is continuous.

E. Fabric: Pull fabric taut and securely tie to posts and rails. Install fabric on interior or playing side of fence except as specified on plans and details, and anchored to framework so that the fabric remains in tension after pulling force is released. Lower edge of fabric shall be level with finished grades at 1-1/2 inches above grade (typ.).

F. Wire Ties: Tie fabric to line post, rails, and braces with wire ties (sizes above), spaced 12 inches O.C. (typ.). Tie fabric to tension wire, if no bottom rail is required, with hog rings (sizes above) at 18 inches O.C. (typ.).

G. Tension Bars: Fabric shall be attached to the terminal posts by means of single piece tension bars. Thread through fabric and secure to posts with metal bands spaced not over 12 inches O.C. (typ.).

3.4 WELDING

A. All field welds shall be fully filled, ground flush and smooth and all heat and process affected areas to be treated with finish to match fabric.

B. All welding shall be completed by certified welders.

C. All welding shall be completed on posts prior to galvanic and powder coating process. Any welding completed in the field will be inspected by Owner's Representative. Any found with non-conforming finishing will have posts replaced.

D. All field welding shall be ground smooth, primed and painted with an approved primer and paint for metal.

1. Two coats of primer shall be used.
2. Three coats of finish paint shall be used. Paint shall be black in color and match finish of powder coating.

3.5 PRECAST SPLIT RAIL CONCRETE FENCE

A. Contractor to install precast split rail concrete fence per manufacturer's instructions, Construction Drawings, and specifications.

3.6 CLEANUP

A. Job site shall be cleared of all excess materials (concrete, wire, rails, pipe, etc.). All areas impacted by construction shall be restored to as good as or better than the original condition, as approved by the Owner.

END OF SECTION

SECTION 32 41 00
SITE FURNISHINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK INCLUDED:

A. Provide all labor, materials and equipment necessary to supply and install the following:

1. Removable Bollards
2. Waste Receptables
3. Pebble Benches

1.2 QUALITY ASSURANCE:

A. Manufacturer's Instructions: Adhere to manufacturer's instructions for product handling, assembly, installation, and maintenance.

B. Manufacturer’s original factory finish must be intact for the installation to be considered satisfactory. On-site touch-up will not be accepted.

1.3 SUBMITTALS:

A. For each Product Specified, submit the following for approval prior to delivery:

1. Manufacturer's product data.
2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Always comply with Manufacturer’s recommendations.

B. All products shall be supplied as specified, or approved equal. Refer to Division 01 Specifications for Product Substitution requirements.

2.2 WASTE RECEPTACLES

A. Waste receptacles shall be BigBelly Smart/Element DBL and Big Belly Smart Max/Element DBL , 1-888-820-0300, info@bigbelly.com, https://bigbelly.com/products/bigbelly-smart-max, or approved equal.

2.3 REMOVABLE BOLLARDS

A. Bollard shall be manufactured as shown on the plans.

2.4 PEBBLE BENCHES

A. Pebble Benches shall be SRC Pebble benches by QCP Corporation in the quantities, colors and finishes shown below:

Qty	Description	Product Number	Color	Finish
5	24x18 Pebbles Product	QPEBBLE7-24SRC	Natural	Strata
2	36 x 14 Pebbles Product	QPEBBLE2-36SRC	French Grey	Strata
1	42” x 15” SRC Pebble	QPEBBLE3-42SRC	French Grey	Strata
2	56”x 37-5/16” Pebble	QPEBBLE5-56SRC	French Grey	Strata

2.5 FURNISHINGS INSTALLATION MATERIALS:

A. Other materials required for product installation which may not be supplied or shipped by the manufacturer or otherwise specified for fabricated items include the following;

1. Concrete for Direct Burial Footings: Concrete for direct burial post footings shall per Plans and in accordance with the manufacturer's recommendations and Section 03 30 00 – Cast In Place Concrete.
2. Anchoring Devices for Bolt-down, Surface Installation: Where the manufacturer does not provide a specification for anchoring, use only approved stainless steel wedge anchors as follows;
    a. Size to the largest standard diameter that the manufacturer’s pre-made hole will accommodate without force, typically 5/8”
    b. Anchor length to be ¾ of the actual depth of concrete to support the installation.

PART 2 - EXECUTION

2.1 EXAMINATION:

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

2.2 GENERAL:

A. In general, the Work is to proceed as rapidly as the site becomes available.

B. Protect all fabricated elements and finishes during the construction period.

C. Remove debris from other trades prior to beginning work.

D. Install all furnishings plumb and level.

E. For installation of the pebble benches, layout benches prior to installation to ensure that the spray park's required 4' walkoff zone is maintained. Failure to maintain the 4' walkoff zone may result in the need to re-set the benches to bring them into compliance, which shall be at the contractor's expense.

2.3 DIRECT BURIAL INSTALLATION

A. All below-grade steel components scheduled for direct burial installation shall be coated in an approved manner prior to installation, typically either factory powder coating or hot-dipped galvanized.

B. Provide footing excavations sized per measured plans provided with the Contract Drawings, manufacturers printed assembly and installation instructions, or as directed by the Engineer, typically 12" diameter x 18" depth for most installations under 100 lbs/footing.

C. Coring and Saw-cutting:

1. All products scheduled for direct burial installation within new paved areas are to be installed prior to paving.
2. In the event that paving is installed prior to site furnishings scheduled for direct burial installation, saw-cutting will not be approved as a means of penetrating pavements. Coring, to the specified size of the footing, is the only method that may be considered.
3. Do not core completed work of the Contract to accomplish product installation without prior approval of the Engineer.
4. Where site furnishings are scheduled for installation in existing pavement of any type or where the Engineer has approved coring of pavement installed as part of the work of the Contract, the Contractor shall insure an adequate supply of clean water and continuously flush and clean cuttings from pavement surfaces to remain.

D. Concrete footings shall be neatly and evenly crowned slightly above adjacent finished grade where adjacent finished grade is generally level, matching adjacent finished grade where adjacent finished grade is sloped, or level to the bottom of base aggregate where installation in paved areas is scheduled.

E. Remove all concrete slurry from surrounding surfaces and site furnishings prior to request for inspection.

2.4 SURFACE MOUNT INSTALLATIONS

A. Surface installations shall be made only upon approved concrete surfaces.

B. Use only manufactured approved mounting bracket and anchoring devices.

C. Where the manufacturer does not provide a specification for anchoring, use only approved stainless steel wedge anchors as follows;

1. Do not proceed with anchor installation until concrete pavement has had a minimum of 14 days cure time under normal conditions. Where weather conditions are beyond the range of normal, do not proceed with anchor installation without the approval of the Owner's Representative.
2. Size to the largest standard diameter that the manufacturer's pre-made hole will accommodate without force, typically 5/8".
3. Size for embedment of ¾ of the actual depth of concrete to support the installation, in no case less than 2½". Allow for depth of nut plus 3-5 threads protrusion above finished installation. Match or exceed structural notes.
4. Do not over drill beyond 1/8" the depth necessary to accommodate the anchor.
5. Torque to 80-85% of the anchor manufacturers recommended maximum.
6. Provide at least one anchor for every bolt location hole for any site furnishing.

2.5 INSTALLATION OF MANUFACTURED ITEMS

A. Install all equipment in accordance with Specifications, Drawings and manufacturer's directions. Where these may be in conflict, the more stringent requirements govern.

PART 3 - INSTALLATION OF FABRICATED ITEMS

A. All fabricated items shall be installed consistent with the measured plans provided in the Contract Drawings utilizing materials described therein.

3.2 CLEANUP

A. Remove all metal, wood, and concrete debris, protective wrappings and coverings, and shipping materials from the project site. Remove all residues, repair all stains, scuffs, abrasions, and marks from the finished product prior to requesting inspection. Fully restore all areas of the site that were impacted by the installation activities.

END OF SECTION

SECTION 32 50 00
LANDSCAPE BOULDERS AND STONES

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. General: Deliver to the site and place landscape boulders and stones in conformance with the Construction Drawings and under the direction of the Owner's Representative.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Division 01 Specifications.

1. Product data and source for each type of stone.
2. Shop drawings as noted.
3. Photos of boulders for verification purposes of form and size, color, grade, finish, and rock type required.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility for Boulders: Obtain boulders from a single quarry with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to place the material without delaying the progress of the work.

B. Single-Source Responsibility for Stones: Obtain stones from a single quarry with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to place the material without delaying the progress of the work.

C. Information on the Drawings and in the Specifications establishes the requirements for both aesthetic effects and performance of the boulders. Aesthetic effects relative to formal characteristics are indicated by dimensions, arrangement, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction; performance is indicated by criteria subject to verification either by preconstruction or field test, if applicable, or by in-service experience.

D. Do not modify intended aesthetic effects, except with the Owner's Representative's approval, and only to the extent exclusively needed to comply with the performance requirements. Where modifications are proposed, submit comprehensive explanatory narrative/data for review.

E. Installer Qualifications: Installer shall be an experienced landscape boulder placement technician with at least 3 years of documented experience placing boulders.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site in undamaged condition.

B. Store and handle the boulders and related materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or other causes.

C. Do not use pinch or use wrecking bars.

D. Lift with wide-belt-type slings where possible; do not use wire rope or ropes containing tar or other substances that might cause staining.

PART 2 - PRODUCTS

2.1 BOULDERS

A. Landscape Rock

Supplier:	Washington Rock Quarries, Inc. , Ph. (253) 262-1661, or approved equal.
Finish:	Natural.
Size:	A mix of 2 – 3 man boulders as needed to construct rockery walls per plans.

B. Stone

1. Supplier Coldspring Granite, 17482 Granite West Road | Cold Spring, MN 56320-4578; D:320-685-4830 www.coldspringusa.com

2. Finish: Split face finish on exposed edges, sawn finish on faces receiving mortar. Natural on edges that are buried.

3. Sizes shall be confirmed by contractor prior to installation. We anticipate the following:

3” x 22” x 18” - 16 stones
6” x 22” x 18” - 33 stones
3” x 26” x 18” – 16 stones
6” x 26” x 18” – 24 stones
3” x 32” x 18” – 12 stones

3” x 32” x 23” – 28 stones
3” x 36” x 18” – 11 stones
3” x 36” x 18” 17 stones
3” x 42” x 18” – 3 stones
6” x 42” x 18” – 10 stones

C. Mortar shall conform to WSDOT 9-20.4(3) Mortar Type 2 for Masonry Applications

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas to receive the boulder and stone placement, and the conditions under which the boulders and stones will be installed, with the Installer present, for compliance with the requirements for installation and other conditions affecting the performance of the placement. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect the stonework during stone setting as follows:

1. Prevent staining of the stone from caulking or paving materials. Immediately remove such materials from the stone without damage to the latter.
2. Protect boulders and stones from damage from construction machines and materials.
3. Clean stone surfaces that have become dirty and stained prior to setting. Remove soil, stains, and foreign materials. Clean stones by thoroughly scrubbing stones with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh filler or abrasives.

3.3 SETTING STONE, GENERAL

A. Set the stones to comply with the requirements indicated on the Construction Drawings.

B. Broken, chipped, stained, or otherwise damaged stone shall be replaced until the methods and results are acceptable to the Owner’s Representative.

3.4 MORTAR SETTING

A. Mortar set landscape stones in place following the project documents. Mortar joints shall be solidly filled, recessed from the face of the stone to the depth of the stone as shown in the contract drawings.

3.5 PROTECTION:

A. Provide final protection and maintain conditions so no damage occurs to the stonework until Physical Completion is approved.

B. Any stonework damaged prior to Physical Completion shall be replaced and rebuilt at no cost to the Owner.

3.6 CLEANUP

A. Remove all metal, wood, and concrete debris, protective wrappings and coverings, and shipping materials from the project site. Remove all residues, repair all stains, scuffs, abrasions, and marks from the finished product prior to requesting inspection. Fully restore all areas of the site that were impacted by the installation activities as acceptable to the Owner.

END OF SECTION

SECTION 32 80 00
IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install Automatic Irrigation Systems in conformance with the drawings and specifications, complete and ready for use. The work consists of furnishing all materials necessary for a complete and fully-functioning installation, including, pipe, pipe sleeves, wire sleeves, fittings, back-flow prevention device assemblies, valves, valve boxes, swing joints, sprinkler heads, control and communications equipment and enclosures, and all appurtenances related thereto. Included must be all labor necessary for installation, including trenching, plumbing, back-filling, electrical work, adjustments, and all other items of labor necessary for a satisfactory operating system.

1.2 QUALITY ASSURANCE

A. Basic Qualifications - The Contractor must be a Washington State Landscape Industry Professional that has passed the Certified Landscape Professional (CLP) exam. The irrigation system must be installed under the direct supervision of a Certified Irrigation Technician or Journey Plumber. All potable water system components must be installed by a Washington State Licensed Plumber and all testing of the backflow prevention equipment must be done by a Washington State Certified Backflow Assembly Tester (BAT).

1.3 DEFINITION

A. Within this specification section the term “The Engineer” refers to the Park Engineer and all their representatives that may be involved with the project. Those may include (but are not limited to) SeaTac Parks Superintendent, SeaTac Construction Manager and Inspection Staff, SeaTac Facilities Maintenance staff (including Plumbers and Electricians), and SeaTac Resource/Operations Staff (including District Senior Gardeners and other maintenance staff) as required and appropriate for the project.

1.4 REFERENCE SECTIONS

1. Section 31 00 00 - Earthwork

1.2 SUBMITTALS

A. Submit complete materials list prior to performing any work. Submit manufacturer catalog data and full descriptive literature, including current manufacturer's price list.

B. Equipment or materials installed or furnished without prior approval of the Engineer will be rejected and such materials will be required to be removed and replaced with approved materials at the complete expense of the Contractor.

C. Submit shop drawings for review and approval prior to beginning work.

1.3 PROJECT CONDITIONS:

A. Underground utilities and elements: The Contractor must call Utility Notification Center at (811) or (800) 424-5555 or webpage www.callbeforeyoudig.org to locate all underground utilities (on or near Public Rights-of-Way / Property Lines) prior to digging and/or driving stakes. The Contractor can also engage the services of a private utilities locating service for location of utilities within the site by calling Locating, Inc. @ (425) 392-6412, CNI @ (206) 255-8650 or Applied Professional Services @ (425) 313-1034 to locate utilities within the site. (Note: these firms will charge for services rendered).

B. Site Inspection and Layout: Before proceeding with any work, the Contractor must inspect the site, carefully checking all grades and verifying all dimensions and conditions affecting the work to satisfy themselves that they may safely proceed. Changes or alterations to the system to meet actual conditions must be made at the Contractor's expense. Always use appropriate fittings for changes in direction or elevation. Do not bend the pipe more than that allowed by this specification. The irrigation plan is diagrammatic and is not intended to show exact locations of existing or proposed piping, valves or controllers. Locate new items as closely as possible to related curbs, walls, fences or edges of paving. Pipelines shown parallel on drawing may be placed in a common trench but separated by at least 6 inches and all pipes of dissimilar materials must be installed per UPC and SeaTac standard details included with the plans. Sprinkler heads are shown accurately and must be installed as indicated by center of symbol.

C. When renovating or working around an existing park irrigation system, the Contractor and the Engineer (including the SeaTac Plumbing and Maintenance personnel) must test and document the condition of the existing system prior to the Contractor beginning the work.

D. All materials must be inspected by the Engineer (including the SeaTac Plumbing and Maintenance personnel) prior to installation of any and all materials required to complete the work. The Contractor must call the Owner to make arrangements for inspections.

E. Contractor must take precautions to neither disturb nor damage any existing above ground or underground utilities or elements. Keep streets, sidewalks and site clean and free from debris, and affected drains open and free flowing at all times.

F. During the installation of the new irrigation system, if underground utilities are encountered, including (but not limited to) existing irrigation systems, the Contractor must notify the Engineer two (2) working days in advance and perform repairs to that system per this section and/or as directed by the Engineer. This must also apply to the connection of new irrigation systems to existing older systems. Repairs and connections must be done per SeaTac Standard Details and/or as directed by the Engineer in the field. (Note: No telescoping repair couplings will be allowed).

1.4 IRRIGATION SYSTEM WARRANTY:

A. Contractor must provide a minimum One Year warranty.

B. The Warranty must include restoration of planted or paved areas due to settlement of trenches.

C. The Warranty may include one complete winterization and one complete de-winterization of the irrigation system, depending on Physical Completion date. For example, if the Project is Physically Complete in November, the Contractor will have Winterized prior to Physical Completion, and De-winterize under the Warranty Period. If the Project is Physically Complete in July, the Contractor will provide Winterization the following October and De-winterization the following March, under the Warranty Period.

PART 2 - PRODUCTS

2.1 WATER DISTRIBUTION SYSTEM PIPING:

A. Brass Pipe and Fittings:

1. Brass pipe must be seamless red brass per ASTM B 43 rated for 250-psi working pressure.
2. All Brass Pipe and fittings must conform to industry standards and be in conformance with applicable ASTM or ANSI standards.
3. Brass fittings must be Class 250 fittings rated for a minimum of 250-psi working pressure and must conform to ANSI/ASME B16.15 and ASTM B584.

B. PVC (Polyvinyl Chloride) Pipe, Fittings, Primer and Glue:

1. All PVC Pipe must be Schedule 40 PVC (or better) and must conform to all requirements of ASTM D1785-86.
2. All PVC Pipe must be marked with the manufacturer's name, class of pipe and NSF seal. Pipe must bear no evidence of interior or exterior extrusion marks. Pipe walls must be uniform, smooth and glossy. Pipe may be pre-belled or with individual solvent-weld couplings.

3. All PVC Pipe must be solvent welded pipe. All PVC pipe must be delivered in at least twenty foot (20') lengths.
4. All PVC fittings must be of the solvent welded type except where risers, valves, etc., require threaded transition fittings. All threaded PVC tees, fittings, adaptors and nipples must be Schedule 80 PVC (or better) and must conform to the requirements of ASTM D2466-78.
5. All PVC pipes and fittings for swing joints must conform to all requirements of ASTM D3139. No additional threaded PVC nipples of any kind are allowed in swing joint fabrications. All swing joints must be threaded into Schedule 80 PVC tees or Schedule 80 PVC 90-degree ells that are glued into the Schedule 40 mainline and lateral pipes.
6. Use Teflon tape on all threaded fittings, regardless of pipe type.
7. Primer color must be Purple and glue color must be Gray.

C. Sleeves:

1. Sleeves required for main and lateral lines located under paving (pathways and service roads within the park site) where vehicles are anticipated, must be Schedule 40 PVC (or better). The inside diameter (I.D.) of the sleeve must be twice (2 times) the outside diameter (O.D.) of the inserted pipe with a maximum of one (1) insert pipe per sleeve. All wiring must be in its own separate Schedule 40 PVC sleeve, independent from the piping sleeves.
2. Sleeves under roadways (street rights-of-way, boulevards or parkways) where heavy vehicular traffic is anticipated, must be ductile iron pipe. The inside diameter (I.D.) of the sleeve must be at least twice (2 times) the outside diameter (O.D.) of the total inserted pipes with multiple pipes inserted per sleeve (only as directed by the Engineer). All wiring must be in separate Schedule 80 PVC (or better) electrical conduit (min. 2” O.D.) within the ductile iron pipe.
3. All sleeves must be inspected and approved by the Engineer after forms are placed (for wall penetrations) and/or before paving operations are executed.

D. Backflow Prevention Devices (BPD): May include a Double Check Valve Assembly (DCVA):

1. The backflow prevention devices must meet the requirements specified in the plans. Proper drainage must be provided at all backflow prevention devices. Drainage problems must be brought to the attention of the Engineer at the time of system layout.
2. The backflow prevention devices must be type and size as shown on the Plans and Details or approved equal.
3. The manufacturer must be on the "Approved Cross Connection Control Devices" list of the Washington State Department of Social and Health Services for that size device.

E. Pressure Reducing Valve (PRV):

1. PRV must be capable of a minimum 150 psi working pressure as specified. Pressure fall off through the PRV must not exceed designer's specified limit. PRV must be the same size as the mainline where installed.
2. PRV must be of the type, manufacture and size shown on the Plans and Details and/or the following: for (3/4" to 2") use Wilkens 600 Series PRV, for (2-1/2" and larger) use Wilkins 500 Series PRV with Wye Strainer: Watts No. 777S, or approved equal.

F. Manual Valves:

1. Gate Valves (GV): must be flanged, iron body, brass trimmed, resilient double disc wedge, and integral taper seats with non-rising stem . Small (smaller than 2") must have wheel handle, large sized (2" and larger) gate valves must have square actuators. All gate valves must be Class 150 with a minimum 150 psi - 300 WOG. Gate Valves: Must be Kennedy, Mueller, or Hammond, or approved equal.
2. Curb Stop Valves: must be all bronze construction with 'tee' handle, 175 psi water working pressure, Mueller Oriseal Mark II, or approved equal.
3. Manual Drain (Stop & Waste) Valves: must be all bronze construction, 175 psi water working pressure, Mueller Oriseal Mark II H-10284, or equal.
4. Manual Valves (MV): (Size varies) must be of types, manufacture and sizes as shown on the Plans and Details and/or as specified in this Section.

G. Quick Coupling Valves (QCV):

1. Must be of the type, manufacture and size shown on the drawings and/or the following: Buckner QB44LRC-10 with 1 inch outlet, single lug 2-piece with locking lid and matching key, or approved equal. All quick coupling valves must be installed in a 10" diameter valve box, as shown on the Details.
2. Must be one (1) inch, all brass, and two piece bodies, with locking brass tops and have galvanized steel swing joints as shown in the Details. Provide five (5) operating keys and hose swivels on each project.

H. Swing Joints:

1. Swing joints for quick couplers must be triple swing joints using schedule 40 galvanized steel with threaded fittings. Swing joints must consist of street ells, ells, and nipples for full adjustability. Galvanized swing joint, quick coupler assemblies must be installed in valve boxes, per the Details.
2. Pre-fabricated swing joints, for irrigation heads, must be triple swing joints, using Schedule 80 or Class 315 PVC threaded fittings. Swing joints must consist of street ells, ells, and nipples for full adjustability. Fittings must have "O" ring seals.

I. Pop-up sprinkler Heads:

1. All heads must have a built-in pressure-regulating device. The device must regulate nozzle pressure to the design pressure. The pressure-regulating device must be an internal part of the pop-up stem.
2. The heads must have matched precipitation rate nozzles with adjusting screws.
3. All heads must have screens under the nozzles.
4. The heads must be equipped with check valves to prevent low head drainage. The check valves must hold back pressures equivalent to 10 feet of head.
5. The heads must be of types, manufacture and sizes shown on the Plans and Details and must be from the following list:

    a. For Athletic Fields and Large Lawn Areas use: Toro 640 Series, or Hunter I-20 or I-40 Series Heads, or approved equal. All large throw rotor heads must have stainless steel risers, if available.
    b. For Medium-sized Lawn Areas and/or Large Shrub Bed Areas use: Hunter 1-20 Series Heads, or approved equal. All heads must have stainless steel risers, if available.
    c. For Small/Narrow Lawn Areas & Strips and Shrub Bed Areas use: Rainbird 1800-SAM-PRS-MPR Series, or approved equal. VAN nozzles on spray heads should be very limited, but will be allowed provided they have matched precipitation rates for the zone in which they are used.

J. Automatic Control Valve Assemblies:

1. Valves must be of types, manufacture and sizes as shown on the drawings and/or the following: For (¾" to 2" O.D.) use Buckner/Superior VB/HD Series - 2-way solenoid brass valve with 24 VAC -50/60 Hz coil, or approved equal. For (2-1/2" O.D. and larger) use Superior 950 Series valves, or approved equal. If contaminated or dirty water conditions exist, "Buckner" VBDW valves must be used, or, approved equal.
2. Valves must be of all brass construction or iron body, bronze-mounted, globe pattern. The valve pressure rating must be 150 psi min. All connections must be brass pipe, threaded.
3. Valves must be electrically operated, actuated by a solenoid utilizing AC current, 24 volts, and rated at not more than 8.5 VA with an in-rush maximum of 1.0 amp. The solenoid coil is to be sealed in an "Epoxy" material so it is completely waterproof.
4. Operation of all valves must be normally closed solenoid control capable of operating within minimum flow requirements.
5. Diaphragm operated of one-piece construction. The diaphragm must be fully pressure balanced in both the open and closed positions.
6. Solenoid must be mounted directly on the valve or bonnet. All parts and tubing downstream of the entrance must be of larger size to permit passage of foreign particles.

7. A flow adjustment stem with cross handle must be provided that limits the travel of the valve plug from full closed to full open, allowing manual closure or flow regulation. A manual control must be provided for operation with or without the control wiring installed.
8. Construction must be such that all operating parts are accessible and removable from the top by removing the bonnet without having to disconnect the valve body from the pipeline. The valve must be capable of being operated in any position.
9. All automatic control valve assemblies must include a manual shut-off valve upstream of the solenoid valve. The shut-off valve must be a Mueller Oriseal Mark II, or approved equal.

K. Wiring for Automatic Control Valves, Master Valves and Flow Sensors:

1. Automatic Control Valve Wires must be insulated single strand copper designed for twenty (20) to fifty (50) volts and UL approved as Type U.F. (Underground Feeder). The UL and U.F. designations must be clearly marked or indented on the insulation jacket of the wire.
2. Expansion curls must be provided within three (3) feet of each wire connection to solenoid and at least every three hundred (300) feet in length of control wire length. Expansion curls are formed by wrapping at least 5 turns of control wire around a rod or pipe 1” or more in diameter. Withdraw the rod or pipe once curls are formed.
3. Color coded wires must be used for all control wires and the following colors are the only colors that will be accepted:

    a. Power (or lead-in) - Black or Red
    b. Common (or neutral) - White
    c. Spares (see below) - Orange

4. One (1) unconnected Spare Wire (color Orange) for each four (4) zones) must be run from the controller through each intermediate control valve box. Provide at least a twenty-four inch (24") long, tight loop for each wire in each box. For clarification; zones 1 thru 4 require one spare wire, zones 5 thru 8 require an additional spare wire, and zones 9 thru 12 require an additional spare wire, and so on. Where control valves run in multiple directions from the controller, at least one (1) separate spare wire must be run in each direction. The spare wire(s) must always be installed to the farthest valve(s) location(s) from the controller.
5. The Master Valve must be installed with separate power and common wires which must be different colors than the other control wires. A spare wire must also be installed to the Master Valve. The following wire colors are the only colors that will be accepted:

    a. Power - Blue
    b. Common – Yellow
    c. Spare – Orange

6. The Flow Sensor must be installed with a PE-89 Shielded Communication Cable as manufactured by Regence, or approved equal. This cable must be installed with no splices accepted other than where cable is attached to flow sensor, unless as approved by the Engineer. Approved splice kit must be Super Serviceseal Closure with Poly-bee, or approved equal, to make that splice.
7. Copper conductors must meet or exceed ASTM B-3 requirements

L. Master Valves/Flow Sensors/Flow Monitors:

1. Master Valves: Normally Open when MV is located on the same mainline as the Quick Coupler Valves (QCV)..

    a. The Master Valve must be of the type, manufacture and size shown on the Drawings and/or the following: Superior Series #3100 (for normally Open up to 3" O.D. size) or approved equals.
    b. The Master Valve must be a normally Open electric solenoid actuated valve. The valve must have an NPT inlet and outlet. The valve must be capable of working at pressures of up to 150 psi.
    c. The Master Valve must meet all of the requirements for Automatic Control Valves as noted above.
    d. The Master Valve must be installed with separate power and common wires which must be different colors than the other control wires. The wire colors must be blue (power) and yellow (common).

2. Hard Wired Flow Sensor and Flow Monitor:

    a. The Flow Sensor must be a Rainbird, Model #FS-200P (X=pipe size). Flow sensor should be sized based on expected range of flows.
    b. The Flow Monitor must be a Rainbird, Model #PT-3002.
    c. The thermoplastic Flow Sensor must have a six bladed impeller with a proprietary, non-magnetic sensing mechanism. The transmitted signal must be a low impedance 8 VDC square wave signal. The maximum transmitted signal distance must be 2000 feet.
    d. The Flow Sensor must include a Schedule 80 PVC tee fitted with a removable sensor insert.
    e. The Flow Sensor must be installed in a PVC jumbo valve box, green color.

M. Valve Boxes:

1. Valve boxes must be of the type, manufacture and size shown on the Plans and Details and/or the following:

    a. Use Pentek or NDS Pro Series 10 inch diameter round valve boxes with locking lids for quick coupler valves, green color, or approved equal.

b. Use Pentek Super Jumbo Valve Boxes with Pentagon Lock or NDS Pro Series Jumbo boxes with bolt down locking lids and extensions as required (for single valve assembly only), green color, or approved equal.
c. Backflow Prevention Device Assemblies and pressure reducing valves (1-1/2" O.D. and larger) must be installed in a Fogtite #25-TA Concrete Vault, or approved equal, as shown on the Plans and Details. or approved equal, with metal lid and extensions and/or bricks as required.
d. Use Pentek or NDS Pro Series 6-7 inch diameter round box, or approved equal, for grounding rods, green color.

2. Automatic control valves must be enclosed in valve boxes of HDPE or polyolefin and fibrous material (preferably recycled material) with locking lids. The bottom must be slotted so as to extend below the pipe. Extensions must be added as required to meet grades per the Details. Automatic control valves must read ACV, master valve boxes must read MV, cast iron gate valve boxes must read WATER, etc.
3. Manual drain valves and individual gate valves must be enclosed in a Cast Iron Roadway Box, as manufactured by Olympic Foundry, Tyler Pipe, or Pentek "Polyiron" 5-1/4" valve box, or approved equal, with bottom, top, and lid, sized and extensions, as required. Lid must have the word "water" printed on it.
4. Provide two (2) sets of all keys required for valves, valve box covers, and protective sleeve covers unless otherwise noted.
5. Occasionally, valves may need to be installed in athletic field areas of play. In those cases valve boxes must be installed underground with the box cover 6" below finished grade and must have covers with a 4 inch by 4 inch by 1/8 inch thick steel locator plate attached to the top of the cover. Clearly locate on as-built drawings using latitude/longitude for GPS location, or dimensions to fixed objects (e.g. curb edge, or other non-buried valve boxes).

N. Drip Irrigation
1. Tubing shall be Hunter PLD Drip Tubing.
2. Provide all necessary fittings, AVR valves, headers and flush valves as need to have a fully functional drip irrigation system.

O. Automatic Irrigation Controller and Communications Equipment:

1. Shall be a Toro Sentinel 36-zone satellite controller (model number TS-WSR-36-WS1-NR-50HC).

2. Controller:

a. The Controller must be hard wired in conduit. All conduits must be UL approved electrical conduit minimum size 1 1/2-inch diameter, 18-inch deep minimum.
b. The Conduit size for irrigation control wires must be minimum 1-1/2-inch diameter or greater to allow for all wires to be installed in a single conduit.

c. The Communication Cable, or approved equal must be the type recommended by the irrigation controller manufacturer. No splices in the communication cable will be allowed unless approved in writing by Engineer.

3. All controllers, communications and other required electrical equipment must be grounded (to a resistance of less than 10 ohms) using an array of three ground rods per the Details.

P. Other Supplies:

1. Electrical tape must be black plastic, three-quarters inch (3/4") wide and a minimum of 0.007 inches thick and the all-weather type.
2. Teflon tape must be used for all threaded connections. Tape must be set back a minimum of one quarter inch (1/4") into the pipe threading.
3. Pressure gages for the pressure reducing valve assembly must be liquid-filled with one quarter inch (1/4") gage cock attached, or approved equal.
4. Encapsulate all control valve wire splices with approved splice kit with sealant. The Wire Splice Kit is the 3M-DBY splice kit, or approved equal.
5. Grounding array must consist of at least three (3) eight feet (8') long by 5/8" diameter copper rods.
6. When tying a irrigation system piping into an existing system, a "Romac" Model #511 (long version) repair coupling is required. No telescoping repair couplings will be allowed. An isolation valve is also required at that point of connection to allow for pressure testing of the new system.

Q. Identification:

1. Underground - Type Plastic Line Markers (Detect-a-Tape): Permanent, bright-colored, continuous-printed plasticized aluminum tape, intended for direct-burial service; not less than 3" wide x 5 mils thick and must be placed directly over the pipes at 6" below finished grades. Provide blue tape with black printing reading "CAUTION IRRIGATION LINE BURIED BELOW".
2. Valve zone identification tags are required and must be Christy's ID Tags, as manufactured by Christy Concrete Products, Inc., Portland, OR, or approved equal. Tags must be made of polyurethane, incorporating an integral attachment neck and reinforced attachment hole and will be capable of withstanding 180 pounds pull force. Tag must be 2 1/4" x 2 3/4" in size. All lettering must be hot stamped in black and capable of withstanding outdoor use. Tag color must be yellow,must double-sided, and stamped with zone valve number.

R. Backfill Materials:

1. For backfill around all irrigation heads use common builder's sand.

2. For suitable bedding material around all pipes and equipment as shown on the Details, use: native topsoil with no rocks or other debris more than 1 inch diameter or common builder's sand per Section 31 00 00 Earthwork.

PART 3 - EXECUTION

3.1 LAYOUT OF IRRIGATION SYSTEM

A. Stake the irrigation system following the design shown on the Plans before construction begins. Alterations and changes to the layout may be expected in order to conform to the site conditions and to obtain full and adequate coverage of area to be irrigated. It is understood that corrective measures in the system may become necessary, but no changes or alterations to the system as planned must be made without the prior authorization of the Engineer.

B. Before starting work, determine that work may proceed without disruption of the activities of other trades.

C. The Contractor must carefully check grades to ensure that the area is ready to begin work.

D. The Contractor is responsible for taking all reasonable investigative actions and precautions when working around all utility systems.

3.2 TRENCHING

A. The contractor may save and maintain any sod from the ditches and replace it after system installation. Sod must not be displaced for more than 72 hours. If the sod dries out is otherwise improperly maintained or damaged during this period, it must be replaced with new sod at no additional cost to the Owner. Survival of the sod must be warranted .

B. Exercise care when excavating trenches near existing trees per Section 01 56 39 - Temporary Tree & Plant Protection. Where roots are two inches (2") and greater in diameter hand excavate and tunnel. When large roots are exposed, wrap with heavy burlap for protection and prevent excessive drying. Trenches dug by machines adjacent to trees having roots two inches (2") and less in diameter must have the sides hand trimmed making a clean cut of the roots. Trenches having exposed tree roots must be back-filled within twenty-four (24) hours unless adequately protected with moist burlap or canvas.

C. The top six inches (6") of soil must be kept separate from subsoil and must be replaced as the top layer when backfill is made.

D. Trenches must be excavated for all pipe to provide the minimum depth of cover below finish grade of 24" for live lines (mains), and 18" for laterals and all others, no wider at any point than is necessary to lay the pipe or install equipment. Trenches must be excavated with vertical sides. Locate outside of paved areas wherever possible.

E. Materials unsuitable for bedding of pipe to be removed to a depth 4" below trench bottom, and replaced with suitable bedding material as directed by the Engineer. Suitable bedding material must be: excavated trench material, free from rocks, roots, sticks, debris or other sharp objects over one inch in diameter; or sand, as required.

F. All trenches must be straight, with appropriate pipe-fittings used to allow pipe to be laid without undue bending and not have abrupt changes in grade.

G. The trench bottom must be free of rocks or sharp-edged objects.

H. The use of an underground vibratory plow or similar device to pull pipe will not be permitted.

3.3 INSTALLATION

A. Brass Pipe and Fittings

1. Brass pipe must be installed in accordance with the local Plumbing Code and as shown on the Plans and Details.
2. Use 'Teflon' tape on all male threads to prevent leaks and corrosion.
3. Wrap all brass pipes with black PVC tape where they pass through grouted openings in concrete vaults.

B. Solvent Welded PVC Pipe and Fittings:

1. The Contractor must exercise care in handling, loading, unloading and storing to avoid damage. The pipe and fittings must be stored under cover, and must be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat, so as not to be subject to undue bending or concentrated external load at any point. Any pipe that has been dented or damaged must be discarded until such damage has been cut out and the pipe is rejoined with a coupling.
2. PVC pipe ends must be cut to ninety (90) degrees to the pipe length and cleaned of all cutting burrs prior to cementing. Use approved reaming tool. Pipe ends must be wiped clean with a rag and lightly wetted with PVC primer. Cement must be applied with a light coat on the inside of the fitting and heavier coat on the outside of the pipe. Pipe must be inserted into the fitting and given a quarter turn to seat the cement. Excess cement must be wiped from the outside of the pipe. Pipe will be tested as indicated elsewhere in these specifications. No back filling will be permitted other than at the centers of pipe lengths until the pressure test is completed.

3. Appropriate primer must be used with solvent glue. Solvent welded joints must be given at least fifteen (15) minutes set-up time before moving or handling. Pipe must be partially center loaded to prevent arching and slipping. No water must be permitted in pipe until a period of at least ten (10) hours has elapsed for solvent weld setting and curing.
4. Before pressure testing, soluble weld joints must be given at least twenty-four (24) hours curing time.
5. No PVC pipe may be threaded or connected to a threaded fitting without an adapter. Use Teflon tape on all male threads.
6. Great care must be taken to ensure that the inside of the pipe is absolutely clean. Any pipe ends not being worked on must be protected and not left open.
7. Repairs or connections to existing PVC pipe must be done using 'Romac', or approved equal fittings, as shown on SeaTac Standard Details. 'Romac' Model #511 (long version) repair coupling is required. No telescoping repair couplings will be allowed. An isolation valve is also required at that point of connection to allow for pressure testing of the new system.

C. Sleeves:

1. Pipe trenches located under areas of existing or new paving must have sleeves installed. Sleeves must extend 12" beyond the pavement on each side. Trenches must be back-filled with sand (6 inches above and 4 inches below the pipe) and compacted in layers to 95% compaction, using manual or mechanical tamping devices. Trenches for piping must be compacted to equal the compaction of the existing adjacent undisturbed soil and must be left in firm unyielding condition. All trenches must be left flush with the adjoining grade. The Contractor must set in place; cap and pressure test all piping under paving prior to paving work.
2. All sleeves installed by the Contractor prior to and during the installation of the rest of the irrigation system must be inspected by the Engineer and the SeaTac Plumbing Shop with at least two (2) working days prior notice by calling the SeaTac Inspection Request Line at 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice.

D. Backflow Prevention Device Assembly:

1. A Water Service Line must be installed from the meter or the union at the property line to the Backflow Assembly. The Water Service Line installation must be inspected prior to backfilling .
2. Install the Backflow Prevention Device Assembly in accordance with the current local plumbing codes, and as shown on the Details.
3. For proper maintenance, the Backflow Prevention Device Assembly must be located with sufficient clearance from other site features, not in paving and away from traffic patterns.

4. The Backflow Prevention Device Assembly must be installed in a specified and approved vault per the Details.
5. Drain valves must be installed in accordance with current local plumbing codes and per the Details.
6. All Backflow Prevention Device Assembly installations, including DCVA, require testing and certification by a Certified Backflow Assembly Tester (BAT), hired and paid for by the Contractor, prior to substantial completion and acceptance.
7. The device assembly must also be inspected by SeaTac's Plumbing Shop. To arrange for that inspection the Contractor must call the SeaTac Inspection Request Line @ 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice.

E. Manual Valves:

1. All manual (gate, isolation, lateral isolation, shut-off or drain) valves must be installed as shown in the SeaTac Standard Details.
2. Gate, isolation and lateral isolation valves must be installed in an adjustable two-piece cast-iron roadway box designed with tabs (lugs) on cover with 5 inches minimum inside diameter. The top section must be 18 inches minimum length with a valve cover marked "WATER".
3. All gate valve assemblies must be installed at least 24" away from any other valve boxes, vaults or other equipment or structures to allow for ease of maintenance and replacement, as shown on the Details.

F. Quick Coupling Valves:

1. Quick coupler valves must be located as shown on the plans or at approximately 100' intervals, unless otherwise directed by the Engineer through the design review process. One additional quick coupling valve must be installed at the Point of Connection (POC) for use of compressed air for winterizing the system.
2. All quick coupling valves must be installed in a 10" diameter valve box as shown on the Details.

G. Risers and Swing Joints:

1. All pop-up sprinkler heads and quick coupler swing joints must be constructed as shown on the Details.
2. Minimum riser size must be the pipe size of the sprinkler head.
3. All threaded joints must have Teflon tape (approved for PVC pipe) applied to male threads only. No pipe dope is allowed.
4. Risers are to be capped after installation in preparation for pressure testing.
5. All pop-up sprinkler heads and quick couplers must have swing joints that allow the head or quick coupler to be set perpendicular and flush with finish grades.
6. In no case must the heads be set with swing joints at maximum extension, thus preventing future adjustment.

H. Pop-up sprinkler Heads:

1. Install all sprinkler heads as shown on the Plans and Details.
2. Spacing of heads must not exceed spacing shown on the Plans for any reason.
3. Heads along curbs, walks, paving, etc. must be placed 1/2 inch above finish grade and no closer than 4 inches from paving edge.
4. All impact sprinkler heads located in athletic turf areas must be equipped with rubber covers.
5. All heads must be set perpendicular to finish grade unless otherwise designated on the Plans.
6. Backfill around heads with sand, as shown on the Details.

I. Automatic Control Valves:

1. Install as shown on the Plans and Details.
2. Before installation of any automatic valves, the supply line must be thoroughly flushed.
3. All Automatic Control Valve Assemblies must be enclosed in jumbo valve boxes with valve box extensions as required, as shown on the Details.
4. Install only one (1) valve assembly per valve box.

J. Master Valve/Flow Sensors:

1. Install Master Valve/Flow Sensors per manufacturer's specifications.
2. Coordinate wiring with control equipment (blue and yellow wires required).
3. The Master Valve is the Normally Open type, its wires must be connected to Station # 24 on the terminal strip. Use terminal #12 if the controller is smaller than a 24 station controller.
4. All Master Valves and Flow Sensors must be enclosed in valve boxes with valve box extensions as required, as shown on the Details.

K. Wiring:

1. Control wires must be taped together at five (5) foot intervals with black electrical tape; then this bundle must be taped to the bottom of the supply lines at ten foot (10') intervals with at least three (3) wraps of electrical tape. A bare copper wire (#14 or greater) must be installed on top of the PVC supply line for future detection with the wire ends clearly exposed in the valve boxes.
2. Tie a loose 24 inches long loop in all wiring at changes of direction greater than 30 degrees. Untie all loops after all connections have been made.

3. Splices are permitted only at junction boxes, valve boxes, or at control equipment and never between valves or valve and controller. A minimum of 24 inches of excess conductor must be left at all splices, terminal and control valves to facilitate inspection and future splicing. All splices must be encapsulated with sealant in approved splice kit. The splice kit must be a 3M-DBY type water-proof wire splice, or approved equal. If a splice between the controller and valve is required due to damage to existing valve wires, the splice must include minimum 24 inches excess length of control wire added at the splice location. At the break location, two splices are required to complete the repair. The splices (two per break) must leave splice kits unburied, and must be housed in a separate rectangular valve box and brought to finish grade.
4. One (1) unconnected Spare Wire (color Orange) for each four (4) zones) must be run from the controller through each intermediate control valve box. Provide at least a twenty-four inch (24") long, tight loop for each wire in each box. Where control valves run in multiple directions from the controller, at least one (1) separate spare wire must be run in each direction. The spare wire(s) must always be installed to the farthest valve(s) location(s) from the controller.
5. A schedule diagram (zone chart) must be posted in the controller to facilitate the selection of the valves to be operated.
6. Minimum size of wire is to be determined strictly by the following chart:

Number of Valves	Maximum Length of Common Wire			
	500'	1000'	2000'	3000'
1	14	14	14	14
2	14	14	14	10
3	14	14	10	8
4	14	14	10	8
5	14	10	8	6
6	14	10	6	6
7	14	8	6	4
8	14	8	6	4
9	14	8	4	4
10	10	6	4	2
11	10	6	4	-

7. The Flow Sensor Wire - PE-89 Shielded Communication Cable, or approved equal, must be installed with no splices accepted other than where the cable is attached to the flow sensor, unless as approved by the Engineer. Splice kit used to make that splice must be a Super Serviceseal Closure with Poly-bee, or approved equal. At least a five foot (5') loop of excess cable must be left at the point of connection in the controller enclosure to ensure that enough slack is available for connection to the controller.

L. Automatic Controllers:

1. Install irrigation Controllers per manufacturer's specifications and shop drawings.
2. Electrical wiring (120 V.A.C.) must be installed according to local code. A licensed electrician must perform hard wiring of controller, and the work must be permitted per City of SeaTac requirements. The cost of all electrical work necessary to make the automatic equipment operate properly must be included in this Contract.
3. Conduit for power supply wires must be installed as shown on Plans and Details and controller manufacturers shop drawings. The ends of all conduits, whether shop cut or field cut, must be reamed to remove burrs and rough edges. Cuts must be made square and true. Conduit bends, except factory bends, must have a radius of not less than six times the inside diameter of the conduit. A 3/16-inch polyethylene pull rope must be installed in all conduits with two feet of pull rope extended beyond the conduit openings and then secured. All conduits must be free of debris. All conduit openings must be sealed with duct tape to prevent fouling.
4. The controller enclosure must be properly grounded per the Details.
5. A diagram of schedule (zone chart) must be posted in the controller to facilitate the selection of the valves to be operated.
6. Install decoders, transmitter and all control equipment in controller housing per manufacturer's specifications.
7. Satellite Communication and other required equipment: The Contractor must notify the Engineer when the “Sentinel” controller panel is installed so that Parks staff can test the controller. The contractor must also provide the Engineer with the keys and/or other tools necessary to operate/drain/activate the system and spend sufficient time with the Engineer to ensure that the system operation/maintenance/winterizing can continue after departure of the Contractor.
8. The Contractor must be liable for all damage or loss resulting from failure to comply with the provisions of this paragraph. All of the above procedures must be done before the Functional Test can occur, as described below.

M. Backfilling:

1. Backfilling must be done when pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system for a short time before back-fill, or by back-filling in the early part of the morning before the heat of the day.
2. While backfilling the trenches fill and tamp around, 4 inches below and 6 inches above the pipe and fittings with approved suitable bedding material, or sand as required. The remainder of the backfill must contain no lumps or rocks larger than three inches. A six inch separation is required between all pipes when more than one pipe occupies the trench. If no sodding is required, the top 6 inch of backfill must be replaced by topsoil where it exists (free of rocks over one inch, subsoil or trash) or selected fill soil or sand if soil conditions are rocky.

3. All roots, rocks and surplus excavation must be removed from the site unless otherwise directed. Any turf areas buried under ditch excavation must be raked clean of any excavated material.
4. Trenches under roads or paved areas must be back-filled and tamped with a mechanical tamper in successive six inch (6") lifts. Paving must be replaced to the satisfaction of the Engineer.
5. Prior to completing backfill, place detection tape 6 inches below finished grades and directly above the installed lateral and supply mains for future line detection. Provide extra length to clearly expose ends in the valve boxes.
6. Before complete back-filling, all underground appurtenances including risers, valves, double check valve assembly, drain valves, and joints must remain exposed so that they can be viewed during testing.
7. The location, inspecting and testing provisions of these specifications will be strictly adhered to. If, for any reason, any part of the sprinkler system is back-filled before approved location, testing, or inspection is authorized, it must be completely uncovered and exposed until approved for back-filling by the Engineer.

3.4 CLEAN-UP

A. Upon completion of operations and prior to watering, clean all adjoining areas such as paving, curbs, and lawns of debris caused by the work on this project, or any part of this project. All hard surfaced areas must be washed clean. Daily clean up mustis required on all areas used for circulation, parking, or other daily use.

3.5 TESTING AND INSPECTIONS:

A. Pressure Testing:

1. Make hydrostatic tests in the presence of the Engineer and SeaTac's Plumbing Shop. No pipe must be backfilled until it has been inspected, tested and approved.
2. Furnish necessary pump, gauges and all other test equipment.
3. All PVC main lines with gate (isolation) valves installed and closed must be flushed and pressure tested with all joints exposed to one hundred fifty (150) psi until watertight. Maximum psi loss in a thirty (30) minute test period must be Zero (0) PSI.
4. Similarly, all PVC lateral lines with risers installed and capped must be flushed and pressure tested with all joints exposed to service line pressure required for design for 30 minutes. If the system requires a pump, the service line pressure is required with the pump in operation. Maximum PSI loss allowed must be zero (0) PSI. The Engineer and SeaTac's Plumbing Shop must visually inspect all lateral lines, joints, and swing joints for leakage.

5. To be valid, all tests must be witnessed and approved by the Engineer and SeaTac's Plumbing Shop. The contractor must give at least two (2) working days notice prior to the anticipated date of inspection by calling the SeaTac Inspection Request Line @ 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice.
6. All gauges used in the testing of water pressures must be certified correct by an independent testing laboratory immediately prior to use on the project. Gauges must be re-tested when directed by the Engineer and SeaTac's Plumbing Shop.
7. An Inspection Report must be made and submitted by the Engineer and SeaTac's Plumbing Shop immediately after the completion of testing.

B. Wire Inspection:

1. Prior to backfill of any trenches that include wiring, all wiring must be inspected in the presence of the Engineer and SeaTac's Electrical Shop.
2. No trenches with wiring must be backfilled until it has been inspected and approved.
3. The contractor must give at least two (2) working days notice prior to the anticipated date of inspection by calling the SeaTac Inspection Request Line @ 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice.

C. Equipment Surveying:

1. Upon the Engineer's approval of the Pressure Test, the Contractor must locate main lines and lateral lines and transfer that information onto the red-lined plan, to be passed along to the Consultant for final "As-Built" Record Document preparation.
2. The Contractor must provide that service at their cost or can request that the Engineer provide survey services (if agreed to by the Engineer, in advance) before the backfilling of trenches can be completed.

D. Coverage Test:

1. Before the irrigation system will be accepted, the Contractor, in the presence of the Engineer, must perform a water coverage test for each zone of the system. This test must be performed using only the power supplied from the metered power drop supplied by Seattle City Light. Never perform this or any other testing of the irrigation system equipment using power supplied by a portable generator. The Contractor must be responsible for changing nozzles, etc., at the discretion of Engineer, in order to obtain full coverage with minimum over spray. The Contractor will be required to adjust and/or replace nozzles, etc. as necessary to meet this requirement. Prior to arrival of the Engineer, the Contractor must accomplish the following: complete all work including balancing, adjusting the system (pressure reducing valves, flow adjustment keys, nozzles, etc.) to provide optimum coverage without fogging.

2. Notify the Engineer at least two (2) working days in advance of coverage test by calling the SeaTac Inspection Request Line @ (206) 684-7032 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice.

E. Functionality Test:

1. functionality test of the control/communication systems must be performed and demonstrate that all parts of the system function as specified or intended.

F. Complete System Inspection (Preliminary Punch List):

1. Upon approved completion of the Coverage Test, trenching and installation of all equipment, the Contractor must request a Complete System Inspection of the entire irrigation system including: backfilling, irrigation heads, valves, valve boxes, controller and all other equipment.
2. From this inspection, a punch list must be prepared by the Engineer and presented to the Contractor for completion. The Engineer must give a date for completion of the punch list, not to exceed ten (10) working days.

G. Substantial Completion:

1. Contractor must write a letter to the Engineer requesting substantial completion of the irrigation system.
2. Refer to Division 1 Specifications for information about how the irrigation system must be determined to be substantially complete.

H. System Operation Orientation Session:

1. A training and orientation session must be required. The Contractor, the irrigation Sub-Contractor, the Consultant and the Engineer must be present. The date and time of the session must be subject to the approval of the Engineer.

I. Record Documents: It is the Consultant's responsibility to ensure that the following steps are taken to record the "as-built" information of all underground utilities:

1. The Contractor must keep a current working set of drawings with all as-built changes or actual conditions as work proceeds, to be submitted to Consultant at completion of irrigation system installation.
2. The Contractor performs all required tests, audits, etc. with adequate notice as spelled out in specs.

3. Digitally photograph all pipe, equipment placement, and installation progress on a daily basis. Note photograph locations on a separate record drawing. Include measuring tape, ruler, or other device in photograph to set scale. Digital photographs shall be .jpg format and minimum 72 dpi. Photographs shall be available to Owner's representative as needed. Upon completion of the irrigation system and prior to release of final payment, provide digital photograph files on dvd(s) or usb thumb drive along with legible record drawing of the photograph locations. Place in maintenance manual.
4. The Consultant must prepare AutoCAD record documents with the Contractor's and/or SeaTac Surveyor's "as-built" information included, to be submitted to the Engineer on a CD or DVD along with all other required information, M&O manuals, etc. The CD or DVD must also include .pdf, .jpg or .tif format files of the record documents, along with Mylar hard copies of the record documents to be submitted to the Engineer at Physical Completion of the project.
    a. The "as-built" plans must be reviewed and all features explained. The "as-built" plans must consist of red-lined corrections, notes, comments, etc. on a clean bond paper copy. Any major deviations from the original design (as previously approved) must be documented on the as-builts and explained at the session. All critical dimensions must be shown.
    b. The Consultant must review and approve the "as-built" plans submitted by the Contractor. The Consultant must then prepare AutoCAD Record Documents with the Contractor's and SeaTac surveyor's "as-built" information included, to be submitted to the Engineer on a CD or DVD along with all other required information, M&O manuals, etc. The CD or DVD must also include .pdf, .jpg or .tif format files of the record documents, along with Mylar hard copies of the record documents to be submitted to the Engineer at Physical Completion of the project.
    c. A complete Maintenance and Operations (M&O) Manual must be prepared by the Contractor and three copies of the manual must be turned over to the Engineer at the final inspection. The manuals must consist of three ring binders containing: (1) catalogs of all materials used, (2) a complete parts list of all materials, (3) a written summary of all operations data including start-up and winterization techniques, controller programming, valve cleaning, irrigation adjustments, backflow preventer operation and any other information required to operate and maintain system, (4) two local distributors. A pocket for one (1) copy of the approved photograph record drawings to be added at the time of final inspection, a pocket for digital photograph dvd(s) or usb.
5. Controller Charts:
    a. The record documents must be approved by the Engineer before charts are prepared. The chart must be a reduction of the actual record documents prepared by the Consultant.

b. Provide two controller charts per controller. Controller charts must fit in behind controller door.
c. The Chart must be a bond copy print with a different pastel transparent color to show each separate zone. Verify that the zone number as shown on the Controller Chart matches the number on the actual control valve identification tag. Numbering of zones must be done as specified above in this section.
d. When completed and approved, laminate the chart.
e. The charts must be completed before the project can be considered Physically Complete.

6. The Contractor must provide the Engineer with the necessary keys and/or other tools necessary to operate/drain/activate the system and spend sufficient time with the Engineer to ensure that the system operation/maintenance/winterizing can continue after departure of the Contractor. The Contractor must also provide the two (2) TRC Remotes to the Engineer at this stage. The Contractor must be liable for all damage or loss resulting from failure to comply with the provisions of this paragraph.

J. Physical Completion:

1. Upon completion and approval of all tests, inspections, training, manuals, as-built drawings, and other requirements of this Section, the Engineer must write a letter to the Contractor transferring the project to the Owner's Maintenance and Operation personnel.
2. Physical Completion of the system will be contingent upon Contractor providing signed and approved irrigation/plumbing/health/electrical permits as may be applicable.

K. Irrigation System Warranty for winter work: The Warranty must include one complete winterization and one complete de-winterization of the irrigation system if the project carries over through the winter months.

L. Term of Warranty: The Contractor must be responsible for all work showing defects in materials or workmanship, at no cost to the Owner, for a period of One Year from date of Physical Completion or one year from date of de-winterization, whichever is latest. The Warranty must include restoration of planted or paved areas due to settlement of trenches.

1. A final site meeting must take place eleven months after the date of Substantial Completion or de-winterization, whichever is later. The system must be examined by the Engineer to determine if the system requires alterations or replacements.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes furnishing labor, materials, equipment, and supplies and performing operations required and as defined herein and as shown on the Plans, including without limitation:

1. Preparing subgrade soils;
2. Furnishing and tilling topsoil and soil amendments into prepared subgrade soils; and
3. Protection of completed soil preparation areas.

1.2 QUALITY ASSURANCE

A. Products supplied are to comply with applicable State and Local codes.

B. Contract the services of a qualified Agricultural Chemist, experienced in public or private soils testing and capable of providing specified soil tests required under this Section.

1.3 SUBMITTALS

A. Submit the following:

1. Current (within 2 months prior to installation) test reports from an accredited soils testing laboratory for supplied Topsoil describing composition and nutrient levels. Test reports to include recommendations, as necessary, for incorporation of additional soil amendments to achieve appropriate soil nutrient levels to sustain healthy plant growth. Recommendations for amendments, if required, shall consist of slow-release organic fertilizers to be incorporated into planting beds.
2. Description of equipment and procedures for tilling areas specified for soil preparation.

1.4 SOIL TESTING AND SOIL PREPARATION REVIEW

A. Owner’s Representative will review soil testing reports and soil preparation work specified in this Section prior to commencement of fine grading and planting operations.

B. Provide Owner's Representative with a minimum of three (3) working days notice as to when subgrade and topsoil preparation will be ready for review. Do not schedule review by Owner's Representative until Contractor has confirmed that the relevant soil preparation (subgrade or topsoil) meets the requirements of this Section.

C. Owner's Representative will review soil preparation for conformance with the requirements of this Section. Promptly correct areas of soil preparation that do not conform to the requirements of this Section at no additional expense to the Owner.

D. Failure to comply with the review and approval procedures described in this Section may require full re-preparation of subgrade and reincorporation of topsoil to specified depths.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Soil mix to consist of 2/3 sandy loam and 1/3 Organic Soil Amendment material.

1. Sandy loam or loamy sand to consist largely of sand, but with enough silt and clay present to give it a small amount of stability. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it should form a cast that will hold its shape when pressure is released and withstand careful handling without breaking.
2. The mixed soil shall meet the following gradation:

Screen Size	Percent Passing
3/8 inch	100
#4	95
#10	85
#30	70
#60	50
#100	30
#270	15

3. The mixed soil to have a pH from 5.0 to 6.5 with dolomitic limestone added as necessary to attain this range.

B. Organic Soil Amendments are to conform to the specifications described below.

2.2 ORGANIC SOIL AMENDMENT (COMPOST)

A. Organic Soil Amendment shall be compost and have the following characteristics:

1. Be screened to 7/16-inch.
2. Be free of trash, plastics and debris.
3. Have a pH from 5.5 to 7.5.

4. Have a maximum electrical conductivity of 3.0 ohms/cm.
5. Have a maximum carbon to nitrogen ratio of 40:1.
6. Be certified by the Process to Further Reduce Pathogens (PFRP) guideline for hot composting as established by the United States Environmental Protection Agency.
7. Be fully composted, mature and stable before being acceptable.

B. Substitutions for the Organic Soil Amendment may be accepted. Provide complete chemical and physical laboratory analysis of proposed substitutes. Substitutes will be accepted at the discretion of the Inspector upon proof of their equivalent or superior performance to Organic Soil Amendments.

PART 3 - EXECUTION

3.1 GENERAL

A. Install topsoil once hard surfaces and site furnishings are complete to reduce impact to soil areas.

B. Protect prepared soils from disruption by other Work and construction activities.

C. Remove debris from other trades prior to beginning work.

D. Subgrade to consist of acceptable native soils that, when amended with specified Topsoil, will provide plants with nutrients, positive drainage and appropriate particle sizes that promote long-term plant health and stability. Immediately notify Owner's Representative of poorly draining or unacceptable drainage conditions within landscape areas that will affect the health and maturation of new plantings (to be provided by others).

E. Soil Moisture Content: Do not work soil when moisture content is so great that excessive compaction will occur, when it is so dry that dust will form in the air, or when clods will not break readily.

F. Remove debris, including without limitation, concrete spills or other spills and materials from other trades, prior to beginning Work under this Section.

G. Review existing soil conditions for contaminants that may have been discarded by other trades, such as thinner, paint, plaster, concrete or other debris. Notify Owner's Representative immediately if contaminants are present.

H. Keep streets, sidewalks and site clean and free from debris.

I. For Erosion Control measures, see 01 57 13 – Temporary Erosion and Sediment Controls.

3.2 PRE-INSTALLATION CONFERENCE

A. At least ten (10) days prior to commencement of Work of this Section, schedule an onsite meeting with the Owner, Owner's Representative, and Contractor to review the following:

B. Existing condition of subgrades to receive topsoil. Subcontractor to accept, in writing, the condition of subgrades prior to subgrade preparation, topsoil placement, tilling and planting operations.

C. Planting schedule and potential conflicts with work by other trades.

D. Quality control and maintenance.

3.3 SUBGRADE ESTABLISHMENT AND PREPARATION

A. Inspect established subgrades to verify consistency with the Construction Documents. If subgrades are different than shown on the Construction Documents, notify the Owner's Representative immediately.

B. Coordinate with other project work and the grading plans to achieve specified subgrade depths allowing for common fill (if any), specified amendments and Topsoil as specified in this Section. Mulch and planting to be provided by others.

C. Subgrade depths:

1. New Planting Beds - Minus eleven (11) inches from finish grade to provide twelve (12) inches of topsoil, two (2) inches of mulch (by others), allowing for approximately three (3) inches of settlement.
2. Tree Planting Pits– pit depth and width per detail. Remove cobbles, rocks and debris over two (2) inch in diameter including any fill material such as glass, pipe or metal. Trees shall be planted at sufficient depth that when planted the top of the root crown will be above finish grade.
3. Lawn Hydroseed Areas – Minus five (5) inches from finished grade to provide six (6) inches of topsoil, allowing for approximately one (1) inch of settlement.
4. Meadow Seeding Areas – Minus five (5) inches from finished grade to provide six (6) inches of topsoil, allowing for approximately one (1) inch of settlement.

D. Prepare established subgrades as follows:

1. Till existing subgrade in areas to minus six (-6) inch depth and remove cobbles, rocks and debris, including any large organic debris and fill material such as glass, pipe or metal, over two (2) inch in diameter.

E. Secure approval of subgrade preparation by Owner's Representative prior to implementation of soil preparation procedures.

3.4 SOIL PREPARATION

A. New Planting Beds:

1. Prepare subgrade per above.
2. Place topsoil in two lifts of six (6) inches each, tilling and lightly tamping after each lift is placed.
3. Rake soil smooth to finish grades and remove cobbles, rocks and debris, including any fill material such as glass, pipe or metal, over one (1) inch in diameter.
4. Lightly compact with hand equipment and provide a consistent smooth planting bed. Heavily compact the one (1) foot edge adjacent to pavement to minimize settlement.
5. Mulch to be installed per Section 32 93 01 - Plants.

B. Lawn Seeding Areas:

1. Prepare subgrade per above.
2. Place topsoil in one lift of six (6) inches, tilling and lightly tamping after lift is placed.
3. Rake soil smooth to one (1) inch above finished grades and remove cobbles, rocks and debris, including any fill material such as glass, pipe or metal, over one-half (1/2) inch in diameter.
4. Lightly compact and lightly rake immediately before seed installation. Heavily compact the one (1) foot edge adjacent to pavement to minimize settlement.

3.5 FINISH GRADING

A. Fine grade planting beds to lines and grades shown on the Plans.

B. Fine finish topsoil by raking smooth and even and removing extraneous matter. Work as necessary, until the surface is smooth, friable, and uniformly textured, ready for planting and mulch.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes furnishing labor, materials, equipment, and supplies and performing operations required and as defined herein and as shown on the Plans, including without limitation,

1. Seed bed preparation
2. Application of hydroseeding.
3. Protection of seeded areas designated on the Plans.
4. Sweeping paved surfaces and removing debris following seeding operations and prior to leaving site.
5. Maintenance of seeded areas until Project Acceptance.
6. Warranty on Work and materials.

1.2 QUALITY ASSURANCE

A. Seeding Subcontractor shall be a company specializing in the Work of this Section with a minimum 3 years documented experience in commercial landscape installation of a similar nature.

B. Seeding Subcontractor to provide at least one (1) person as the Lead Foreman who will be present onsite at all times during execution of the Work and who has a minimum five (5) years documented experience in commercial landscape installation of a similar nature. The Lead Foreman is required to be thoroughly familiar with the type of materials being installed and the proper materials and methods for their installation and is to direct Work performed under this Section.

C. Seed to conform to the requirements of the Washington State seed law, and when applicable, the Federal Seed Act, "certified" grade or better.

1.3 SUBMITTALS

A. Submit the following to the Inspector for approval a minimum of ten (10) days prior to start of work under this Section:

1. Seed vendor(s) names, addresses and phone numbers;

2. Certification from each seed vendor for required seed mixture, indicating percentage by weight and percentages of purity, germination and weed seed for each grass and meadow mix species.
3. Other Materials: Product literature, tear sheets and a complete list of product names and suppliers with addresses and contact information for materials proposed, including but not limited to fertilizer, wood fiber mulch, soil binding agent, and other miscellaneous materials, to be furnished and installed. Submittals are to demonstrate product conformance with the relevant requirements in this Section.
4. Documentation of Installer and Foreman experience.

1.4 DELIVERY, STORAGE AND HANDLING

A. Furnish grass seed in unopened containers that show the following information: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material.

B. Furnish meadow mix seed in unopened containers that show the following information: seed mix name, net weight, and seed mix species (percentages of species).

C. Seed that has become wet, moldy, or otherwise damaged will not be accepted.

D. Grass seed shall conform to the requirements of the Washington State seed law and when applicable the Federal Seed Act, and shall be "certified" grade or better. Store seed and fertilizer in such a manner that will prevent wetting and deterioration.

1.5 REVIEW BY OWNER'S REPRESENTATIVE

A. Prior to seeding; request review and approval of soil preparation, soil placement and fine grading of seeded areas by the Owner's Representative. Correct any soil preparation, soil placement or fine grading that does not conform to the requirements of this Section as determined by Owner's Representative.

B. Provide Owner's Representative with a minimum (3) working days notice to perform applicable reviews as described in this Section. Do not schedule review by Owner's Representative until Contractor has confirmed that the relevant requirements of the Contract Documents and this Section have been met. Do not implement seeding operations prior to Owner's Representative approval of soil preparation, soil placement or fine grading.

C. During the One-Year Maintenance Period: Owner's Representative will periodically review seed germination, establishment and maintenance practices until Physical Completion. Deficiencies will be noted and reported to the Contractor. Contractor is required to correct deficiencies, including reapplication of seeded materials to the satisfaction of the Inspector within two weeks notice of deficiencies.

D. Failure to comply with the review and approval procedures described in this Section may require replacement and/or reinstallation of plant materials at no additional expense to the Owner.

PART 2 - PRODUCTS

2.1 SEED MIXES

A. Lawn Seeding Mix:

1. The Lawn Seed Mix shall be composed of the following, by weight:

   a. 35% each two (2) varieties of turf-type perennial ryegrasses
   b. 15% Creeping Red Fescue
   c. 15% Chewings Fescue

2. The Lawn Seed Mix shall also meet or exceed the following:

   a. Minimum pure seed percent - 98%
   b. Minimum germination percent - 90%
   c. Maximum weed seed percent - 0.5%

3. All Seed shall be packed in clean, sound containers of uniform weight.

1.2 FERTILIZER

A. A natural or bridge-type combination fertilizer (part natural, part synthetic slow release), 8-2-4.

1.3 WOOD FIBER MULCH

A. 100-percent fiber, manufactured by the defibrating process, from Fir, Hemlock or Alder; containing no growth or germination inhibiting substances.

B. Mulch to be uniform in weight and dyed a suitable color to facilitate visual measurement of placement.

1.4 SOIL BINDING AGENT

A. A Soil Binding Agent is required.

B. Soil binding agent shall consist of non-toxic, biodegradable materials that are environmentally safe such as MG 250F, Guar Gum Powder, or approved equal.

PART 2 - EXECUTION

2.1 GENERAL

A. Areas will be seeded twice. The initial seeding shall be between April 1st and October 15th. The second seeding shall be the following spring between April and May.

B. Proceed as rapidly as the site becomes available, consistent with normal seasonal and weather limitations for seeding as described herein.

C. Weather Limitations:

1. Proceed with seeding only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.
2. Unless when otherwise approved in writing by Owner’s Representative, seeding operations are not to be undertaken:

    a. During windy weather;
    b. When the ground is frozen; or
    c. When the temperature is below forty (40) degrees Fahrenheit.

D. Remove debris from other trades prior to beginning Work.

E. Review existing soil conditions for contaminants that may have been discarded by other trades, such as thinner, paint, plaster, concrete or debris and notify the Owner’s Representative immediately if contaminants are present.

2.2 SUBGRADE AND SOIL PREPARATION

A. Complete specified subgrade and soil preparation operations, compaction, and clean up of debris prior to seeding per Section 32 91 13 - Soil Preparation. Secure Owner’s Representative review and approval prior to commencement of seeding operations.

2.3 LAWN HYDROSEEDING

A. Coordinate scheduling of hydroseeding operations with Owner’s Representative. Provide Owner’s Representative with a minimum (3) working days notice of seeding operations.

B. Protect any installed porous pavement or porous pavement base course from hydroseeding by applying plastic sheeting over the aggregate/pavement surface.

C. Apply wood fiber mulch, seed, fertilizer and soil binding agent in one operation with approved hydraulic equipment. Apply materials at the following rates:

1. Wood Fiber Mulch – fifty (50) pounds per 1,000 sf.
2. Seed – Restoration Seeding Mix per manufacturer's recommendations.
3. Fertilizer – ten (10) pounds per 1,000 sf.
4. Soil-binding Agent – one (1) pound per 1,000 sf.

D. Equipment to utilize water as carrying agent and a continuous built-in agitation system. Equipment with a gear pump is not acceptable.

E. Application: Pump a continuous, non-fluctuating supply of homogenous slurry to provide a uniform distribution of material over designated areas.

F. Re-Application: Reseed seed by hand, unless very patchy. If there are large bare spots, re-hydroseed per above application instructions.

2.4 CLEANING

A. Perform daily sweeping and cleaning of adjacent pavements and landscape areas during installation of the Work and upon completion of the Work.

B. Remove excess materials, soil, litter, debris and equipment from the site.

C. Restore areas damaged due to seeding operations.

D. Hydroseeding: Immediately clean/wash off hydroseed slurry over-sprayed onto pavements, trees, monuments, site furnishings, and the like before it dries. Immediately remove hydroseed slurry over sprayed onto planting bed areas.

2.5 MAINTENANCE AND ESTABLISHMENT PERIOD

A. General:

1. Protect newly seeded areas for a period of one year by enclosing the area with Plastic Protection Zone Fencing per Section 32 93 01 – Plants, or other means as approved by the Owner's Representative. Fence shall be removed after the One Year Warranty Period.
2. Provide maintenance of seeded areas until Physical Completion. Maintenance to include: watering, manual or mechanical weed removal and control, re-seeding, and for hydroseeded lawn areas only: mowing and applying organic fertilizer, as necessary. Provide written notice of the timing of each weeding operation to the Inspector. For hydroseeded lawn areas, also provide written notice of the timing of each mowing operation.
3. Correct defective work, as soon as possible, after deficiencies become apparent and weather and seasonal limitations permit.

4. Owner's Representative will periodically review maintenance practices until Physical Completion. Deficiencies will be noted and reported to the Contractor. Contractor is required to correct deficiencies to the satisfaction of the Owner's Representative within two weeks' notice of deficiencies.

B. Lawn Hydroseeding:

1. Ensure that seeded areas have germinated to provide a uniform dense cover with minimum 1.5 inches in height and in a healthy growing condition. Reseed bare spots and areas that have less than 75-percent coverage thirty (30) days after hydroseeding.

C. Watering: Watering shall be accomplished as frequently as needed from March through September. At a minimum, a uniform application of 1-inch of water twice weekly shall be required over all seeded areas. The Contractor shall be prepared to water more frequently should dry conditions persist.

2.6 PHYSICAL COMPLETION OF SEEDING WORK

A. Upon request by the Contractor, the Owner's Representative will review the completed seeding work for review and conformance to the Contract Documents. Provide written notification at least ten (10) working days before requested review date.

B. Seeded areas will be accepted provided requirements, including protection and maintenance, have been complied with and plant materials are alive and in a healthy, vigorous condition. All areas failing to vigorously establish within one growing season, for any reason whatsoever, shall be redone at the Contractor's expense. Conditions found unacceptable by the Owner's Representative shall be corrected by the Contractor within five (5) Working Days of such notice. When such correction is required, the establishment period shall extend an additional 45 Days. Areas that are bare (over 6" square), have a poor stand of planting, are dead or dying, have weeds, or have a spotty or non-uniform grade through any cause shall be remedied by regrading, removing and reseeding, and rewatering – and for hydroseeded lawn areas only: refertilizing (as applicable), and remowing – as appropriate.

C. Upon Physical Completion of seeding work, temporary fencing of lawn areas, flagging and warning signs shall be removed by the Contractor.

2.7 MAINTENANCE AND ESTABLISHMENT PERIOD

A. Warrant the Work of this Section for a period of one (1) year from the date of Physical Completion against defects of materials and workmanship.

B. One-Year Warranty Review: A final review with the Contractor may be held if requested by the Owner at the end of the Warranty Period. The Owner will notify parties of the Warranty review a minimum of fourteen (14) days prior to the anticipated meeting date.

C. Contractor shall remove temporary protection fencing from the meadow areas.

END OF SECTION

SECTION 32 93 00
LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide planted trees, shrubs and ground covers as shown and specified. The work includes but is not limited to:

1. Soil Preparation and/or Installing Specified Planting Soils.
2. Installation of Edging
3. Plant Materials and Planting
4. Fertilizing and Mulching.
5. Tree Staking,
6. Installation of Cobbles
7. Maintenance and Establishment.
8. Plant Warranties.

1.2 RELATED SECTIONS:

A. All work of the Contract shall be performed in coordination with the requirements of the following sections:

1. Coordinate with related work specified in other parts of the project manual.
2. Coordinate with the General Conditions and Supplemental Conditions in the Contract.

1.3 REFERENCES

A. All construction shall be in accordance with the City of SeaTac (COS) Design Standards (most recent editions).

B. Comply with sizing and grading standards of the "American Standards for Nursery Stock" (most recent edition).

C. Nomenclature shall conform to “Hortus Third”, compiled by the L. H. Bailey Arboretum, Cornell University, 1976.

1.4 QUALITY ASSURANCE

A. All plants shall be nursery grown or collected materials that has been held in a nursery for at least one year. Nursery climatic conditions must be similar to those in the locality of the project. All plants shall be weed free at the time of planting.

B. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable at no additional cost, and providing that the larger plants will not be cut back to size indicated. Provide plants indicated by two (2) measurements so that only a maximum of twenty-five percent (25%) are of the minimum size indicated and seventy-five percent (75%) are of the maximum size indicated.

1.5 SUBMITTALS

A. Submit the following material samples:

1. Topsoil submittals in accordance with Section 32 91 13.
2. Fertilizers for planting submittal in accordance with Section
3. Mulch submittal in accordance with this Section.

B. Submit the following material certifications:

1. Planting fertilizer
2. Plant material sources

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver fertilizer materials in original, unopened, and undamaged containers showing weight, analysis, and name of manufacturer. The Contractor shall store fertilizer in such a manner as to prevent wetting and deterioration.

B. Dig, pack, transport, and handle plants with care to ensure protection against injury. Inspection certificates required by law shall accompany each shipment invoice or order to stock. On arrival, the certificate shall be filed with the Engineer. Protect all plants from desiccation. “Wiltproof” or another antidesicant shall be applied only with approval of the Engineer. If plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Engineer. Water heeled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches.

C. Cover plants transported on open vehicles with a protective covering to prevent wind-burn.

D. Provide dry, loose soils for planting. Frozen or muddy soil is not acceptable.

E. Stock shall be handled by root ball only, not the trunks, stems or tops.

1.7 PROJECT CONDITIONS

A. Work Notification: Notify the Owner's Representative at least 5 working days prior to the installation of plant materials to make arrangements for inspection.

B. Protect existing utilities, paving, and other facilities from damage caused by planting operations.

C. Do not install plant material when ambient temperatures may drop below 35° F or above 80° F.

D. Do not install plants when wind velocity exceeds 30 MPH.

E. Confine work to designated areas. Do not disturb existing vegetation outside project limits and protect all trees, shrubs and ground covers within project limits not designated to be removed. Do not permit vehicular traffic or materials storage under or around new or existing trees.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

A. Plants: Provide plants typical of their species or variety; with normal, densely developed branches and vigorous, fibrous root systems. Provide only sound, healthy, vigorous plants free from weeds, defects, disfiguring knots, sunscald injuries, and abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation. All plants shall have a fully developed form without voids, open spaces, broken branches, flush cuts or stubs.

1. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and absorbing root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock." Cracked or mushroomed balls are not acceptable.
2. Bare-root plants: Dug with adequate fibrous roots, covered with a uniformly thick coating of mud by being puddled immediately after they are dug, or packed in moist straw, sawdust or peat moss.
3. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

    a. No plants shall be loose in the container.
    b. Container stock shall not be pot bound.

2. No pruning wounds shall be present with a diameter of more than one (1) inch and such wounds must show vigorous callous on all edges. Trees shall not be pruned within six (6) months prior to delivery.

1.2 SOILS

A. Planting Soil: All planting shall be done with 100% specified Planting Soil (purchased and prepared off site) when the existing soil is determined to be unacceptable per Section 32 91 13.

1.3 PLANTING FERTILIZERS:

A. Fertilizers shall be according to the following:

1. Organic Fertilizer: Use Planting Fertilizer (7-4-9) 'Rainy Pacific NW Blend', shall be 100% Organic Fertilizer as manufactured by Walt's Organic Fertilizer Co., or approved equal, and shall be composed of the following:

Total Nitrogen* (N)	7%
(0.5% nitrate nitrogen (N))	
(6.5% water insoluble nitrogen (N))	
Available Phosphoric Acid (P_2O_5)	4%
Soluble Potash (K_2O)	9%
Calcium	7%

*Shall be derived from fish meal, crab meal fines, kelp meal, fish bone meal, and agricultural gypsum.

B. Recommended Sources for Planting Fertilizers:

1. WILCO, 922 Valley Avenue East, Suite 103, Puyallup, WA 98371, Ph. (253) 841-3378, Fax. (253) 841-8549.
2. HORIZON DISTRIBUTION, Bellevue, WA, Ph. 425-828-4554, Fax 425-822-0419.
3. WILBUR-ELLIS, 16300 Christensen Road, Tukwila, WA 98188-3418, Ph. (206) 439-9950.
4. Or, approved equal. (Provide manufacturer's written analysis by way of substitution request, for approval by the Engineer, prior to delivery).

1.4 ROOT BARRIERS

A. In locations as shown on the plans and details, root barrier material shall be installed at 18 inch deep, interlocking reinforced polypropylene panels, or approved equal. Recommended sources for root barriers are as follows:

1. "DeepRoot", as manufactured by Deep Root, Inc., and distributed locally by Berkey Supply, Inc., Woodinville, WA, Ph. 425-487-3310 or www.berkeysupply.com.
2. Or approved equal.

1.5 MULCHES

A. Mulches shall be according to the following:

1. Arborist Wood Chip Mulch: Used for most general shrub beds, all native plantings and all Natural Areas restoration plantings:

a. Procurement. For Project Sites located within the City limits of Seattle; the Contractor shall procure arborist wood chip mulch Materials from only approved sources as specified by the City of Seattle, City Purchasing and Contracting Services (http://www.seattle.gov/contracting/construction.htm).

b. Arborist Wood Chip Mulch shall be coarse ground wood chips (approximately 1/2" to 6" along the longest dimension) derived from the mechanical grinding or shredding of whole trees or portions of trees. It may contain wood, wood fiber, roots, bark, branches, and leaves, but may not contain visible amounts of soil. It shall be free of weeds and weed seeds, and may not contain more than 1% by weight of manufactured inert material (plastic, concrete, ceramics, metal, etc.). Arborist wood chip mulch, when tested, shall meet the following loose volume gradation:

	Percent Passing	
Sieve Size	Minimum	Maximum
2"	95	100
1"	70	100
5/8"	0	50
¼"	0	40

c. Acceptable substitutes, subject to the engineer's approval, include chipped or shredded woody material, meeting the above size and inert material requirements, derived from composting operation screening ("overs"), or derived from recycling of clean dimensional lumber (e.g. pallets or framing lumber) that has passed through a metal removal process to meet the 1% manufactured inert standard above.

1.6 SUBMITTALS

A. At the Engineer's request, prior to delivery the Contractor shall provide the following:

1. The source of the product and species of trees included in it.
2. A sieve analysis verifying the product meets the above size gradation requirement.
3. A 5 gallon sample of the product, for the Engineer's approval.

1.7 STONE MULCH

A. Stone mulch shall be Foothills River Rock, 2’ to 10’ as provided by Marenakos Rock Center, 425-392-3313, or approved equal.

1.8 PERENNIAL PROTECTION FENCING:

A. Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with nylon zip ties or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts, 2-inch by 2-inch wood posts or rebar with protective caps, spaced not more than 48 inches apart.

B. Height: 48 inches.

C. Color: High-visibility orange, non-fading.

PART 2 - EXECUTION

2.1 INSPECTIONS

A. Finish grading shall be inspected and approved by the Consultant and the Engineer prior to any planting.

B. Plant material shall be inspected and approved by the Consultant and the Engineer at the nursery or site prior to installation. The Contractor shall remove all unsatisfactory material from the site immediately and his/her own expense.

2.2 PREPARATION

A. Contractor shall locate plants by staking with stakes and flags as indicated on the Drawings or as approved in the field. If obstructions are encountered that are not shown on the drawings, do not proceed until the Consultant and the Engineer have approved the locations or selected alternate plant locations.

2.3 INSTALLATION PROCEDURES

A. Plants brought to the planting site shall be bare root, balled and burlapped, or in containers, depending on how specified in the planting schedule in the Contract for the particular type of planting Material. Plants shall not be planted during freezing weather or when the ground is frozen. Plants shall not be planted during excessively wet conditions. Plants shall not be placed on any day in which temperatures are forecast to exceed 80 degrees unless the Engineer approves otherwise. Plants shall not be placed in areas that are below finished grade.

B. Dates to plant: Planting trees, shrubs, and groundcovers within the project site shall be performed during the period between October 1 and April 30. Planting at other times shall only by done by approval of the Engineer.

C. Plants shall be removed from containers in a manner that prevents damage to the root system. Containers may require vertical cuts down the full depth of the container to accommodate removal. All circling roots shall be loosened to ensure natural directional growth after planting.

D. Excavate circular plant pits with scarified vertical sides, except for plants specifically indicated to be planted in beds. Provide planting pits at least twice the diameter of the root system or container. Depth of pit shall accommodate the entire root system. Scarify the bottom and sides of the pit to a depth of four inches. If groundwater is encountered upon excavation of planting holes, the Contractor shall promptly notify the Engineer.

E. Place specified planting soil for use around the balls and roots of the plants.

F. Set plant material in the planting pit to proper grade and alignment. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set crown of plant material at the finish grade. No filling will be permitted around trunks or stems or above grafts on grafted trees. Backfill the planting pits with specified soil or amendment. Do not use frozen or muddy mixtures for backfilling. Form a ring of soil around the edge of each planting pit to retain water.

G. After balled and burlapped plants are set, water in soil mixture around bases of balls and fill all voids.

   1. Remove at least the top 2/3 of the burlap. If burlap has been chemically treated (green color), remove from the planting pit.
   2. Remove completely all plastic wrapping materials, twine, and wires, and wire baskets from root balls.

H. Space ground cover plants using triangular spacing in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Always plant ground covers to within eighteen inches (18") of the trunks of trees and shrubs within planting bed and to within twelve inches (12") of edge of bed.

I. Spread and arrange roots of bare-rooted plants in their natural position. Work in specified planting soil. Do not mat roots together. Cut all broken and frayed roots before backfilling with remaining specified planting soil.

J. Fertilizer Application Rates:

1. 'Rainy Pacific NW Blend' - Broadcast at a rate of 20lbs. per 1000 square feet. Apply once a month for the first four months of the growing season.

K. Mulching:

1. Mulch tree and shrub planting pits and shrub beds with required mulching material at least 2" deep (settled) immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.
2. Mulch ground cover beds with at least 2" deep (settled) immediately after planting is completed.

L. Stone Mulch:

1. Install stone mulch per plans and details.

M. Staking:

1. Stake all deciduous and coniferous trees immediately after planting .

N. Pruning:

1. Prune all trees only to remove broken or damaged branches, or for aesthetic purposes as directed by the Engineer. Branches shall be pruned at the branch collar. Neither stubs nor flush cuts will be acceptable.

2.4 ROOT BARRIER INSTALLATION

A. Install root barrier panel per manufacturer's recommendations and specifications in locations as shown on the contract drawings and as shown on SPR's standard details for tree planting. Install panels immediately adjacent to paving with ribs facing towards the tree roots. Trenches shall be deep enough so that sod or mulch completely covers the top of the barrier panels without causing the surrounding grades to be uneven.

2.5 MAINTENANCE AND ESTABLISHMENT

A. Maintain plantings for a period of at least 30 days after substantial completion of planting operations or until all plants are sufficiently recovered from transplanting and in a healthy growing condition acceptable to the Engineer.

B. Maintenance shall include regular (at least twice weekly) cultivating, weeding, watering, pruning (only as directed), and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.

1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.
2. Straighten, repair and adjust guy wires and stakes as required.
3. Correct defective work, as soon as possible, after deficiencies become apparent and weather and season permit.
4. Water trees, plants, and ground cover beds within the first 24 hours of initial planting, and not less than twice per week (including rain) until Physical Completion.

2.6 SUBSTANTIAL/PHYSICAL COMPLETION

A. Inspection to determine Substantial Completion of planted areas will be made by the Engineer, upon the Contractor's request. Provide notification at least 5 working days before requested inspection date.

1. Planted areas will be accepted provided all requirements, including the maintenance period have been complied with and plant materials are alive and in a healthy, vigorous condition.

B. Upon Physical Completion, the Owner shall assume all plant maintenance.

2.7 PERENNIAL PROTECTION FENCE

A. Provide protection fencing to protect perennial beds during establishment period. Fencing can be reused from soil protection areas. City of SeaTac staff to uninstall fence after perennial beds are fully established following the first growing year.

2.8 CLEAN UP

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

2.9 WARRANTY AND REPLACEMENT

A. Warranty plant material to remain alive and be in healthy, vigorous condition for a period of 1 year after the date of Substantial Completion. Inspection of plants will be made by the Engineer at the completion of planting.

B. Replace, in accordance with the drawings and specifications, all plants that are dead or, as determined by the Engineer, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence. The cost of such replacement(s) is at the Contractor's expense. Warrant all replacement plants for 1 year after Physical Completion, unless otherwise specified.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over 75 MPH, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Remove and immediately replace all plants, as determined by the Engineer, to be unsatisfactory during the initial planting installation.

E. This warranty also applies to existing trees, shrubs and ground covers that are to be removed and heeled-in for later replanting on-site.

END OF SECTION

SECTION 32 93 01
PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes furnishing labor, materials, equipment, and supplies and performing operations required and as defined herein and as shown on the Contract Documents, including without limitation:

1. Coordinating with other work.
2. Procurement, layout and installation of specified plants.
3. Applying mulch.
4. Tree staking.
5. Root barrier.
6. Landscape maintenance until Project Acceptance.
7. Clean up prior to leaving the site.
8. Providing a warranty on Work and materials.

1.2 REFERENCES

A. Plant Names: Conform to “Report” issued by American Joint Committee on Horticultural Nomenclature Second Edition, 1942, and hereinafter called AJCHN. Names not present in this listing are to conform to accepted nomenclature in the nursery trade.

B. Quality Standards: As described in the current edition of “American Standard for Nursery Stock” issued by the American National Standards Institute and hereinafter called ASNS.

1.3 QUALITY ASSURANCE

A. Landscape Subcontractor shall be a company specializing in the Work of this Section with a minimum 5 years of documented experience in commercial landscape installation of a similar nature.

B. Landscape Subcontractor to provide at least one (1) person as the Lead Foreman who will be present onsite at all times during execution of the Work and who has a minimum five (5) years documented experience in commercial landscape installation of a similar nature. The Lead Foreman is required to be thoroughly familiar with the type of materials being installed and the proper materials and methods for their installation and is to direct Work performed under this Section.

1.4 SUBSTITUTIONS

A. Substitutions of plant materials will not be permitted unless authorized in advance in writing by the Owner. If proof is submitted that any plant specified is not obtainable (via a minimum of three (3) written responses from plant suppliers), a proposal will be considered for the use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Such proof shall be substantiated and submitted in writing to the Owner within two weeks of Notice to Proceed. Landscape Subcontractor to provide a minimum of two (2) options for each substitution. Notwithstanding the foregoing, these provisions do not relieve the contractor of the responsibility of obtaining specified plant materials in advance, even if special growing conditions or other arrangements must be made in order to supply specified materials.

1.5 SUBMITTALS

A. Submit the following to the Owner for approval a minimum of ten (10) days prior to start of work under this Section:

1. Landscape Subcontractor and Lead Foreman qualifications as described above.
2. Plant Materials: A complete list of plant materials proposed to be installed, demonstrating conformance with the Construction Drawings and requirements in this Section. The list is to include:

    a. Names, addresses and phone numbers of nurseries and suppliers;
    b. Verification of plant quantities as shown on the Contract Documents;
    c. Written assurance from each nursery that the plants have been secured and reserved for the project.

2. Other Materials: Product literature, tear sheets and a complete list of product names and suppliers with addresses and contact information for materials proposed, including but not limited to mulch, tree-staking materials, and other miscellaneous materials to be furnished and installed. Submittals are to demonstrate product conformance with the relevant requirements in this Section.
3. Mulch: Source name and ½-pound sample of specified Mulch.
4. Root Barrier: a catalogue cutsheet identifying the specified material, and installation instructions.

1.2 REVIEW BY OWNER

A. Plant Materials:

1. Upon Delivery: Owner's Representative will review plant materials onsite upon delivery for conformance with the requirements of this Section, including plant specifications, storage and handling requirements. Immediately remove from the site plants which are not true to name or which do not comply with the specified requirements. Replace rejected plant materials with conforming plant materials.
2. During Construction: Owner's Representative reserves the right to reject plant materials for nonconformance at any time from the delivery of such plant material to the site through the end of the warranty period.

B. Provide Owner's Representative with a minimum (3) working days notice as to when plant materials and plant and grouping layout will be ready for review. Do not schedule review by Owner's Representative until Contractor has confirmed that the relevant requirements of the Contract Documents of this Section have been met. Do not install plant materials prior to Owner's Representative's approval of plant materials on site and proposed layouts.

C. Layout: Owner's Representative will review the layout of trees and other plant materials prior to installation.

D. Failure to comply with the review and approval procedures described in this Section may require replacement and/or reinstallation of plant materials at no additional expense to the Owner.

PART 2 - PRODUCTS

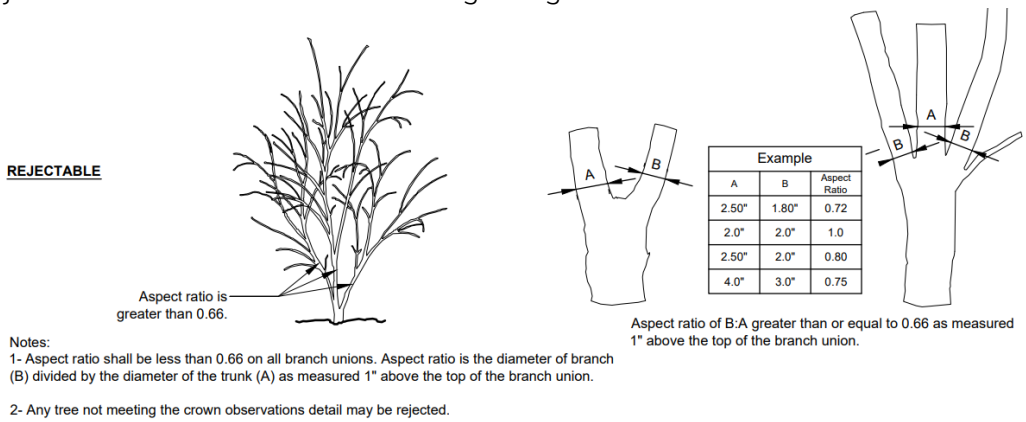
2.1 PLANT MATERIALS

A. General: Plants to be nursery grown in climatic conditions similar to the site. All plant material must meet the current edition of the American National Standard for Nursery Stock, ANSI Z60.1. Measurements, caliper, branching, grading, quality, balling and burlapping are to be as specified and are to follow Code of Standards of American Association of Nurserymen in ASNS unless otherwise specified.

B. Form:

1. Trees and shrubs to have an overall form typical of the species, uniformly branched, with a symmetrical crown. Trees with curved or leaning trunks, damaged leaders, damaged bark, sunscalds, disfiguring knots or fresh cut limbs over 3/4" will be rejected. Trees shall have one central leader (no codominant leaders). Coniferous trees to be in native form (not sheared) with a single dominant leader.

2. Rejectable Tree Stock Observations regarding crown of trees:



C. Roots:

1. The point where top-most root(s) emerges from the trunk (root collar) shall be within the top 2" of substrate. The root collar and the root ball interior shall be free of defects including circling, kinked, ascending, and stem girdling roots. Structural roots shall reach the periphery near the top of the root ball.
2. Trees and large shrubs with girdling roots shall be rejected and are not to be planted except upon special approval by Owner's Representative. Removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Owner's Representative may choose to reject the plant rather than permitting the modification.

D. Plant Size shall meet ASNS specifications on plant size, including:

1. Plants are to be true to species and variety and be at least equal to the size specified.
2. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Plant dimensions are to be measured when branches are in normal position. Caliper measurement is to be taken at a point on the trunk 6 inches above the crown of the rootball for trees up to 4 inches in caliper.
3. Plants larger than specified may be used if approved by the Owner's Representative. Use of such plants shall not increase contract price. If larger plants are used, the ball of earth or container shall be increased in proportion of the size of the plant.

E. Container Grown: Plants to have been grown and cultivated in the containers in which they are delivered for at least six (6) months, but not over two (2) years. Root-bound plants and container plants that have girdling roots, cracked or broken balls of earth when container or wrappings are removed are not to be planted except upon special approval by Owner's Representative.

F. Balled and Burlapped: Plants to have firm, natural balls of soil in sizes shown in ANSI Z20.1, wrapped firmly with burlap or approved material, and bound carefully with twine, cord, or wire mesh.

G. Damaged Plants: Damaged plants will be rejected. Do not prune plants before delivery.

2.2 TOPSOIL

A. See Section 32 91 13 – Soil Preparation.

2.3 MULCH

A. Planting Bed Mulch to be Arborist Wood Chip Mulch as follows:

1. Quality: Arborist Wood Chip Mulch (AWCM) shall be coarse ground wood chips (approximately 1/2" to 4" along the longest dimension) derived from the mechanical grinding or shredding of the above-ground portions of trees. It may contain lumber, manufactured wood products, wood fiber, bark and branches; but may not contain leaves or visible amounts of soil. It shall be free of weeds and weed seeds Including but not limited to plants on the King County Noxious Weed list available at: https://kingcounty.gov/en/dept/dnrp/nature-recreation/environment-ecology-conservation/noxious-weeds/identification-control/noxious-weeds-list, and shall be free of invasive plant portions capable of resprouting, including but not limited to horsetail, ivy, clematis, knotweed, etc. It may not contain more than ½% by weight of manufactured inert material (plastic, concrete, ceramics, metal, etc.).
2. Do not contaminate mulch with invasive plants, plastic, metal, concrete, toxic materials, or other non-biodegradable material.
3. Chipped material from onsite trees that have been removed is acceptable, as approved by the Owner's Representative, as long as it is free of invasive plants such as ivy, blackberry, etc.
4. Gradation. AWCM, when tested, shall meet the following loose volume gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
2"	95	100
1"	70	100
5/8"	0	50
1/4"	0	40

2.4 TREE STAKING MATERIALS

A. Tree Tie: “Chainlock” #5 or approved equal, 1 inch width.

B. Wood Stakes: 2 inch diameter fir wood stakes. Stake length is determined by tree branch height per Construction Drawings. Three feet minimum to be driven into soil, and above-ground stake length to be two feet below lowest branch height.

2.5 ROOT BARRIER

A. Tree root barrier must be installed as a component of planting area preparation - between proposed trees and new asphalt, concrete sidewalk, or mow strip as shown on the Drawings. Panels must be installed flush with the finished grade per Drawings.

B. Panels must be joined with locking strips or integral male/female sliding locks per manufacturer’s instructions. Locking mechanism must have a close tolerance to restrict slippage between panels. Barriers must be installed with root deflectors facing inward. Root barriers must be 18 inches deep and located per Drawings.

C. Root Barrier shall be recyclable, black, injection molded panels manufactured with a minimum 50 percent post-consumer recycled polypropylene plastic with UV inhibitors, and integrated zipper joining system which allows instant assembly by sliding one panel into another; for redirecting tree roots down and away from hardscapes.

D. Backfill operations must be executed to ensure compact soil conditions between the root barrier and bottom of the root ball to avoid settlement or instability of the tree during establishment.

2.6 PLASTIC PROTECTION ZONE FENCING FOR NEW PLANTING:

A. Plastic protection zone fencing for soil protection zone per Section 01 56 39 – Tree Plant and Soil Protection will also protect new planting areas.

PART 3 - EXECUTION

3.1 GENERAL

A. Plant only during the planting season - between April 1st (after the last frost) and October 15th - and after major construction work has been completed unless otherwise approved by the Owner’s Representative.

B. Proceed as rapidly as the site becomes available, consistent with normal seasonal and weather limitations for seeding as described herein.

C. Weather Limitations:

1. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Plant during favorable weather conditions.
2. Unless when otherwise approved in writing by Owner's Representative, planting operations are not to be undertaken:

    a. During windy weather;
    b. When the ground is frozen; or
    c. When the temperature is below forty (40) degrees Fahrenheit.

D. Remove debris and garbage from other trades prior to beginning work.

3.2 PRE-INSTALLATION CONFERENCE

A. At least fourteen (14) days prior to commencement of Work of this Section, schedule an onsite meeting with the Owner's Representative, Contractor and Landscape Subcontractor to review the following:

1. Existing condition of subgrades to receive topsoil. Subcontractor to accept, in writing, the condition of subgrades prior to subgrade preparation, topsoil placement, tilling and planting operations.
2. Submittals.
3. Irrigation and planting schedule and potential conflicts with work by other trades.
4. Quality control and maintenance.

3.3 DELIVERY, STORAGE AND HANDLING

A. Protect plant materials from wind, drought, unusual weather, dehydration, contamination, heating, and vandalism during delivery, storage, and handling. Prevent damage to root balls and leaf desiccation.

B. Deliver branched plants with branches tied and covered with material that allows air circulation.

C. Plant Material Storage and Handling:

1. Protect plants from freezing or drying with protective screening and mulching material.
2. Avoid drying or damaging plants being moved from the nursery or storage area to the planting site.
3. Handle balled and burlapped plants carefully to avoid cracking or breaking the earth ball.

4. Do not handle individual plants by stem, trunk, limbs, or foliage but only by ball or other container.

D. Store non-plant material products in cool dry locations away from contaminants.

3.4 PLANT MATERIAL INSTALLATION

A. Install plant materials in accordance with the Contract Documents.

B. Standard Details: See Contract Documents for tree planting and staking, shrub and ground cover planting details.

C. Stake tree locations and layout other plant materials on-grade. Contractor shall have all plant material placed and/or staked for one review and approval by Owner's Representative prior to digging planting pits. Space ground cover plants in accordance with the triangular on-center dimensions indicated on the Contract Documents. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants.

D. Planting:

1. Orient plants as directed in the Contract Documents or by Owner's Representative for best appearance. Place trees first. Follow with shrubs, then ground cover.
2. Completely remove wire baskets, peat pots and containers. Cutback burlap wrappings and remove ties and all non-biodegradable objects from balled and burlapped rootballs.
3. If the root crown of a plant is found to be buried in the rootball, the Contractor shall remove soil from the top of the rootball to expose the top of the root crown. If this measure is insufficient to gain acceptance from the Owner's Representative, then the Contractor shall immediately replace the plant with another acceptable specimen.
4. Set plants in center of pits, on prepared subgrade or amended soils. Crown of tree root balls to be set approximately two (2) inches above finish grade. Shrubs and groundcovers to bear same relationship with finish grade after settlement as they bore natural grade.
5. Prune or rectify minor circling and girdling roots.
6. Hold tree or shrub firmly in position while topsoil is placed to grade. Place topsoil mixture carefully, avoiding root damage and filling voids. When hole is approximately two-thirds full, compact fill by watering to avoid air pockets. Once water has infiltrated, fill the planting hole with the remainder of planting soil as specified in the Contract Documents.
7. Stake trees per details shown on Contract Documents.

E. Install plants immediately after review and approval by Owner's Representative. If there are unavoidable delays, cover rootballs with moist soil or mulch.

3.5 MULCH

A. Provide two inches (2”) compacted depth Mulch in new planting beds immediately after planting, including planting bed islands and tree wells in lawn areas. Rake mulch to provide a uniform finished surface.

B. At existing trees, verify that mulch is not thicker than three inches (3”) deep and no closer than 24 inches to the trunk of the tree. Remove and dispose of excess mulch.

C. Mulch shall be tapered back to avoid burying small plants. See landscape details on Plans.

3.6 ROOT BARRIER

A. Install root barrier in accordance with manufacturer's installation instructions at locations shown on plans.

3.7 PROTECTION

A. Plant Protection Zone Fencing: Install plant protection zone fencing per Section 01 56 39.

3.8 PRUNING

A. For balled and burlapped plants provide minor pruning of trees and shrubs up to 20% of tree and shrub mass only as directed by the Owner’s Representative to help reduce transplant shock. Prune branches at the branch collar. No stubs nor flush cuts are permitted.

B. Provide minor pruning of trees and shrubs only as directed by the Owner’s Representative to remove broken or damaged limbs or stems and to achieve proper plant branching structure, form and vertical or horizontal clearances. Prune branches at the branch collar. No stubs nor flush cuts are permitted.

C. Prune and trim coniferous tree branching up three (3) feet to four (4) feet from ground only as directed by Owner’s Representative.

3.9 CLEAN UP

A. Perform daily cleaning of adjacent pavements and landscape areas during installation and upon completion of Work;

B. Remove from the site excess materials, plant containers and coverings, soil, litter, debris and equipment;

3.10 MAINTENANCE

A. Provide landscape maintenance until Final Acceptance by the Owner.

B. Landscape maintenance to include: Maintaining trees, shrubs and ground covers in a healthy, vigorous condition, free of insects and disease, by watering, weed removal and control, applying organic fertilizing (if necessary), re-mulching, restaking, straightening or loosening tree ties, removing dead plant material, resetting plants to proper grades or upright position, restoring planting saucers, and pruning (only as directed by Owner's Representative).

C. Correct defective work, as soon as possible, after deficiencies become apparent and weather and seasonal limitations permit.

D. Watering

1. Water trees, plants, and ground cover planting beds within the first four (4) hours of initial planting.
2. Water trees, plants, and ground covers planting beds daily for the first two weeks, one (1) inch per day over approximately one (1) hour to allow water to thoroughly soak into the soil each day there is no rainfall.
3. Deeply water trees, plants, and ground cover planting beds one (1) inch per week over approximately one (1) hour to allow water to thoroughly soak into the soil during rainfall deficit months – at a minimum May through September – until Final Acceptance.

E. Maintenance schedule: Plant and ground cover beds are to be weeded every three weeks during the One-Year Maintenance Period. Provide written notice to Owner's Representative of the completion of each weeding operation.

F. Owner's Representative will periodically review landscape maintenance practices until Project Acceptance. Deficiencies will be noted and reported to the Contractor. Contractor is required to correct deficiencies to the satisfaction of the Owner's Representative within two weeks notice of deficiencies.

3.11 FINAL ACCEPTANCE OF COMPLETED LANDSCAPE WORK

A. Upon request by the Contractor, the Owner's Representative will review the completed landscape work for review and conformance to the Contract Documents. Provide written notification at least fourteen (14) working days before requested review date.

B. Landscape areas will be accepted provided requirements, including maintenance, have been complied with and plant materials are alive and in a healthy, vigorous condition.

3.12 ONE-YEAR WARRANTY PERIOD

A. Warrant the Work of this Section for a period of one (1) year from the date of Final Acceptance against defects of materials and workmanship.

B. During the Warranty Period, make replacements of plant materials within thirty (30) days of awareness of plant death or abnormal growing condition. Plants damaged by vandalism after Project Acceptance or resulting from damage by Owner's occupancy of the site will not require replacement, unless improper installation is a contributing factor in the damage, including improper staking, plant pit size or protection.

C. Plant replacement during the Warranty Period will be limited to one (1) replacement per plant unless repeated failure is due to improper soil preparation, plant installation or the failure of plants to meet the specifications of this Section.

D. Replace plants not in normal healthy growing condition at end of the Warranty Period as determined by Owner's Representative. Replace with plants of identical species and size.

E. For defoliated, but live plants, and at the discretion of the Owner, in lieu of plant replacement the Contractor may extend the Warranty an additional year.

F. One-Year Warranty Review: Notify Owner of Warranty end date one month prior to end of Warranty period. A final review may be held if requested by the Owner in presence of Contractor and Owner or Owner's Representative at the end of the Warranty Period. The Owner will notify parties of the Warranty review a minimum of fourteen (14) days prior to the anticipated meeting date.

END OF SECTION

SECTION 32 96 00
TRANSPLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide spading, burlap & basketing, and storage of existing trees, soil preparation, planting, and staking of same.

1.2 RELATED SECTIONS

A. Coordinate with related work specified in other parts of the project manual.

B. Coordinate with the General Conditions and Supplemental Conditions in the Contract.

1.3 QUALITY ASSURANCE

A. Tree spading shall be accomplished with mechanical equipment designed specifically for the task, operated by trained personnel.

1.4 SUBMITTALS

A. Prior to mobilizing for the work, submit for approval a list of equipment to be used including owners name and address, and personnel who will operate the equipment and oversee the digging, moving, and planting operation described herein.

1.5 PROJECT CONDITIONS

A. Work notification: Notify the Engineer at least 5 working days prior to digging of plant material by calling the Owner's Representative to make arrangements for inspection.

B. Protect existing vegetation, utilities, paving, and other facilities from damage caused by digging operations.

C. Do not install plant material when ambient temperatures may drop below 35° F or above 80° F.

D. Do not install plants when wind velocity exceeds 30 MPH.

E. Confine work to designated areas. Do not disturb existing vegetation outside project limits and protect all trees, shrubs and ground covers within project limits not designated to be removed. Do not permit vehicular traffic or materials storage under or around new or existing trees.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

A. Trees located on the Project Site for reuse.

2.2 BURLAP AND BASKET

A. Biodegradable burlap and galvanized wire tree basket sized appropriately.

2.3 SOILS

A. Refer to Section 32 91 13 - Soil Preparation for information about soils.

2.4 TRANSPLANTING FERTILIZERS

A. Fertilizers shall be according to the following:

1. Use Planting Fertilizer (7-4-9) 'Rainy Pacific NW Blend', shall be 100% Organic Fertilizer as manufactured by Walt's Organic Fertilizer Co., or approved equal, and shall be composed of the following:

Total Nitrogen* (N)	7%
(0.5% nitrate nitrogen (N))	
(6.5% water insoluble nitrogen (N))	
Available Phosphoric Acid (P2O5)	4%
Soluble Potash (K2O)	9%
Calcium	7%

*Shall be derived from fish meal, crab meal fines, kelp meal, fish bone meal, and agricultural gypsum.

B. Acceptable Fertilizer Sources:

1. PROSOURCE ONE, 2920 - 142nd Avenue East, Suite 105, Sumner, WA 98390, Ph. (253) 826-9100, Fax. (253) 826-9110, Contact: Shane Riley (425) 327-0489 or sriley@prosourceone.com.

2. HORIZON DISTRIBUTION, Bellevue, WA, Ph. 425-828-4554, Fax 425-822-0419.
3. WILCO AGRILANCE, LLC, Sumner, WA, Ph. 253-826-9100, Fax 253-826-9110.
4. Or, approved equal. (Provide manufacturer's written analysis by way of substitution request, for approval by the Engineer, prior to delivery).

2.5 MULCHING

A. Arborist Wood Mulch per Section 32 93 00 - Landscape Planting or approved equal.

2.6 TREE STAKING

A. Staking shall be per plans in the plans.

PART 3 - EXECUTION

3.1 INSPECTIONS

A. Finish grading shall be inspected and approved by the Engineer prior to planting.

B. Plant material shall be inspected and approved by the Engineer prior to digging, upon arrival at storage location, following installation, and periodically during the warranty period.

3.2 SPADING

A. Minimum diameter of tree spade to be used for this work is 42" and maximum is 96". Size shall be determined by the Engineer. Setup spading equipment to center cut around base of tree. Following removal, burlap and basket with appropriately sized materials.

3.3 HEALING IN

A. Heal basketed trees in sufficient organic soil amendment to retain the trees in a plumb condition. Organic material shall be full depth from base of basket to top of basket to ensure consistent moisture retention. Alternatively, provide a base of up to 12" of sand for stability.

3.4 TRANSPLANTING LOCATIONS

A. Contractor shall locate trees by staking with stakes or flags as indicated on the Drawings or as approved in the field. If obstructions are encountered that are not shown on the drawings, do not proceed until alternate tree locations have been selected by Engineer.

3.5 INSTALLATION

A. Excavation: Following acceptance of the final planting location by the Engineer, excavate tree planting pits 1.5x the diameter of the tree basket and to a depth that will allow planting with the base of the tree trunk approximately 2" above surrounding finished grade (averaged if irregular). Scarify sides and bottom of tree pit to allow positive interface of planting soil with surrounding undisturbed native soils.

B. Placement: Handle basketed trees mechanically with a sling or rigging, using the basket only to support the weight of the tree. While the tree is still mechanically supported, center within the tree pit and verify that the depth of the pit is appropriate. Use native soil to brace the base of the basket to stabilize the tree while removing the rigging.

C. Backfilling: Using a 50-50 mixture of native soil and planting soil as specified in Section 32 91 13, amended with ½ cup of fertilizer (above), backfill a single 12" loose lift. Flood the remaining exposed excavation with 6-9" of water. Following percolation of the water into the initial lifts of planting soil, backfill approximately ½ of the remaining excavation and begin compacting by foot. Repeat watering procedure, using enough to top remaining excavation. Unwrap burlap from root collar and cut back to current fill limit using a sharp knife or utility blade without disturbing current fill. Following percolation of water into backfill, place remaining soil beginning 1" below the base of the root collar and sloping to a consistent point 1-2" below the top of the excavation cut-line.

D. Mulching: Apply 2-3" of approved chipped brush in a 4' diameter circle centered on the tree base, forming a lip approximately 4-6" deep around the outer 6-9".

E. Staking: Stake all trees immediately after transplanting.

F. Pruning: Prune as directed by the Engineer following acceptance of transplanting and staking operations.

3.6 MAINTENANCE AND ESTABLISHMENT

A. Maintain planting for a period of at least 60 days after completion of transplanting operations or until all plants are sufficiently recovered from transplanting and in a healthy growing condition acceptable to the Engineer.

B. Maintenance shall include cultivating, weeding, watering, pruning (only as directed), and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.

1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.
2. Straighten, repair and adjust guy wires and stakes as required.
3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.
4. Water trees within the first twenty-four (24) hours of initial planting, and not less than twice per week (including rain) until final acceptance.

3.7 PHYSICAL COMPLETION

A. Inspection to determine acceptance of trees will be made by the Engineer, upon Contractor's request. Provide notification at least ten (10) working days before requested inspection date. Planted areas will be accepted provided all requirements, including the maintenance period have been complied with and plant materials are alive and in a healthy, vigorous condition.

B. Upon completion of maintenance period, inspections and corrections, the Engineer shall write a letter to the Contractor establishing the Date of Physical Completion and transferring the project to the Department of Parks and Recreation maintenance and operations personnel.

3.8 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

3.9 WARRANTY

A. The Contractor shall provide a Warranty for the plant material to remain alive and be in a healthy, vigorous growing condition for a period of 1 year after the project’s Substantial Completion Date. Inspection of plants will be made by the Engineer at completion of planting and at the termination of the warranty period.

B. Replace in accordance with the drawings and specifications, all plants that are dead or as determined by the Engineer, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence. The cost of such replacement(s) is at the Contractor's expense. Warrant all replacement plants for 1 year after installation, unless otherwise specified.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over seventy-five (75) MPH, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Remove and immediately replace all plants, as determined by the Engineer, to be unsatisfactory during the initial planting installation.

E. This warranty applies to existing trees that are to be removed and healed-in for later replanting on-site.

END OF SECTION

SECTION 33 11 00

WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered in this Section includes installation of buried water piping systems.

B. References

1. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
2. King County Water District #125 Standard Details
3. King County Water District #125 Standard Notes

C. Submittals

1. Submit the following Project Data for all materials used:

a. Brochures and catalog cuts

b. Product technical data showing that the product meets the requirements of the standards referenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall confirm to:

1. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
2. King County Water District #125 Standard Details
3. King County Water District #125 Standard Notes

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall confirm to:

1. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
2. King County Water District #125 Standard Details
3. King County Water District #125 Standard Notes

END OF SECTION 33 11 00

SECTION 33 31 13

SEWAGE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered in this Section includes installation of buried sanitary sewer piping systems.

B. References

1. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
2. Valley View Sewer District Details and Specifications (2018)

C. Submittals

1. Submit the following Project Data for all materials used:

a. Brochures and catalog cuts
b. Product technical data showing that the product meets the requirements of the standards referenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall confirm to:

1. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
2. Valley View Sewer District Details and Specifications (2018)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall confirm to:

1. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
2. Valley View Sewer District Details and Specifications (2018)

END OF SECTION 33 31 13

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered in this Section includes installation of buried piping systems and buried structures for stormwater.

B. References

1. King County Road Design and Construction Standards (2016)
2. City of SeaTac Addendum to Road Standards (2020)
3. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
4. Geotechnical Report, included in the Appendix to these specifications.
5. King County Surface Water Design Manual (2024 Amended)
6. City of SeaTac Addendum to King County Surface Water Design Manual (2022)

C. Submittals

1. Submit the following Project Data for all materials used:

a. Brochures and catalog cuts

b. Product technical data showing that the product meets the requirements of the standards referenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall confirm to:

1. Section 33 40 10 Underground Detention System
2. Section 33 40 20 Stormwater Media Cartridge Filtration System
3. Section 33 46 16.19 Pipe Underdrain
4. King County Road Design and Construction Standards (2016)
5. City of SeaTac Addendum to Road Standards (2020)
6. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall confirm to:

1. Section 33 40 10 Underground Detention System
2. Section 33 40 20 Stormwater Media Cartridge Filtration System
3. Section 33 46 16.19 Pipe Underdrains
4. King County Road Design and Construction Standards (2016)
5. City of SeaTac Addendum to Road Standards (2020)
6. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)

END OF SECTION 33 40 00

SECTION 33 40 10

UNDERGROUND DETENTION SYSTEM

PART 1 - General

1.1 This item shall govern the furnishing and installation of underground detention and infiltration systems for all types, sizes and designations as shown on the plans.

1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the CMP system, appurtenances and incidentals in accordance with the drawings and as specified herein.

1.3 A stormwater treatment device upstream of the CMP system is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the CMP system and reducing the life cycle cost. Both engineered solutions shall be provided by a single supplier/manufacturer. Filtration by wrapping a system with geotextile is not an acceptable means of pretreatment.

1.4 Applicable provisions of any division shall govern work in this section.

1.5 American association of state highway and transportation officials (AASHTO)

A. AASHTO design section 12 – soil-corrugated metal structure interaction systems

B. AASHTO construction section 26 – metal culverts

C. AASHTO M36 – standard specification for corrugated steel pipe, metallic-coated for sewers and drains

D. AASHTO M274 – standard specification for steel sheet, aluminum-coated (type 2), for corrugated steel pipe

1.6 American society for testing and materials (ASTM)

A. ASTM a760: standard specification for corrugated steel pipe, metallic-coated for sewers and drains

B. ASTM A929: standard specification for steel sheet, metallic-coated by the hot- dip process for corrugated steel pipe

C. ASTM A798: standard practice for installing factory-made corrugated steel pipe for sewers and other applications

D. ASTM A998: standard practice for structural design of reinforcements for fittings in factory-made corrugated steel pipe for sewers and other applications

1.7 Site layout drawings, product specifications, materials, corrugation, gage, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the EOR for review at a minimum of 10 working days prior to bid closing.

1.8 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

A. Before installation of the CMP system, contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

1.9 All proposed alternatives to the CMP system shall conform to applicable above referenced AASHTO and ASTM specifications. NCSPA provides design service life guidance for certain products up to 100 years in recommended environments.

PART 2 - Materials

2.1 Aluminized type ii material shall conform to the applicable requirements of AASHTO M274 or ASTM A929. CMP shall be manufactured in accordance with the applicable requirements of AASHTO M36 or ASTM A760.

2.2 The pipe sizes, gauges and corrugations shall be as shown on the project plans. Joint performance requirements are published in Division II, Section 26.4.2, of the current edition of the AASHTO bridge construction specifications.

2.3 Soil tight, gravity flow, non-pressure, drainage pipe joints shall conform to AASHTO M36 and ASTM A760. Minimum joint spacing shall be 10 ft.

2.4 Overlapping of adjacent pipes are not permitted and appropriate banding must be utilized in order to properly secure individual pipes in place.

2.5 Integral end sections: each barrel of the CMP system shall either be connected to a fitting composing a manifold for hydraulic distribution or have an integrated bulkhead to resist loading at the end/start of the barrel, end cap sections shall not be permitted.

2.6 Material selected shall be flame resistant and capable of retaining 80% of strength when subjected to a temperature of 400 degrees Fahrenheit for one hour.

2.7 All fittings shall be manufactured prior to arriving on the jobsite to ensure structural integrity. Fitting reinforcement shall be in accordance with ASTM A998 and reinforcing details. Bulkhead design and fabrication does not vary with differing coatings on the steel components.

2.8 Bulkheads shall be constructed using 12-gage or heavier material, with both the water and soil side final coatings matching the specified CMP coating. Bulkhead plates must be fully welded to the connecting pipe. The design of bulkheads shall adhere to chapter 8 of the NCSPA CSP design manual, meeting the height of cover design requirements with appropriate reinforcements or a minimum required plate thickness. Additionally, reinforcing members shall be post-coated with zinc-rich paint in accordance with AASHTO M 36 for galvanized & aluminized CMP systems.

2.9 The manufacturer of the CMP system shall be one that has regularly been engaged in the engineering design and production of these systems for at least fifteen (15) years and which has a history of successful production, acceptable to the EOR.

2.10 Sampling, testing, and inspection of metal sheets and coils used for manufacturing the CMP system shall be in accordance with to the above applicable referenced specifications. All fabrication of the product shall occur within the United States.

PART 3 - Performance

3.1 The CMP system proposal shall be sized in accordance to the design provided and approved by the engineer of record (EOR). Any contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, hydrocad modeling and engineering drawings.

3.2 The CMP system shall comprise of manhole access with minimum dimensions of 24 inches diameter to provide adequate inspection and maintenance without restrictions and obstructions to entry into interior of the CMP system. Manholes shall be provided to allow full entry into and visual inspection of the complete CMP system, at a minimum as to allow full maintenance of the CMP system. Cleanouts or inspection ports are not acceptable access points for maintenance and inspection nor are any other alternatives which do not allow for full entry into the system.

3.3 The CMP system shall be designed for a minimum HS-20/HS-25 final live loading conditions. The CMP system shall meet HS-20/HS-25 loading requirements with a minimum of 12-inches of cover to bottom of flexible pavement for pipe spans less than or equal to 96 inches and 18 inches of cover to bottom of flexible pavement for pipe spans greater than 96 inches.

3.4 The CMP system shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by transporting stormwater through stone.

PART 4 - Execution

4.1 The CMP system installation shall be in accordance with AASHTO Standard Specifications For Highways Bridges, Section 26, Division II or ASTM A798 and in conformance with the project plans and specifications.

4.2 The CMP system shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. Handling & assembly shall be in accordance with national Corrugated Steel Pipe Association's (NCSPA) recommendations.

4.3 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the pipe. The height-of-cover shall meet the minimum requirements shown in the table below. The use of heavy construction equipment necessitates greater protection for the pipe than finished grade cover minimums for normal highway traffic.

Minimum cover (ft) requirements

Pipe span (inches)	Axle loads (kips)			
	18 - 50	50 - 75	75 - 110	110 - 150
12 - 42	2.0	2.5	3.0	3.0
48 - 72	3.0	3.0	3.5	4.0
78 - 120	3.0	3.5	4.0	4.0
126 - 144	3.5	4.0	4.5	4.5

4.4 Minimum cover may vary, depending on local conditions. The contractor must provide the additional cover required to avoid damage to the pipe. Minimum cover is measured from the top of the pipe to the top of the maintained construction roadway surface.

4.5 Refer to the manufacturer's corrugated metal pipe detention design guide for additional guidance regarding installation, inspection and maintenance.

4.6 The contractor shall follow Occupational Safety And Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

4.7 Backfill material shall be placed in 8 inch loose lifts and compacted to 90% AASHTO T99 standard proctor density.

4.8 Supplier will conduct an on-site preconstruction meeting with the contractor prior to the scheduled delivery date of the CMP system.

END OF SECTION 33 40 10

SECTION 33 40 20

STORMWATER MEDIA CARTRIDGE FILTRATION SYSTEM

PART 1 - General

1.1 The contractor shall furnish and install the stormwater media cartridge filtration system, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents. The water quality treatment flow shall be as determined and approved by the engineer of record.

1.2 The stormwater media cartridge filtration system shall consist of an underground precast concrete, steel or plastic structure that houses passive, radial flow, siphon-actuated, and rechargeable media filled filtration cartridge(s). The rechargeable media-filled filter cartridges shall incorporate a protective hood over the media cartridge and a siphon-actuated surface self-cleaning mechanism to increase the effective life of the filter media and to reduce the accumulation of material on the cartridge/media interface. Each radial-flow filter cartridge shall operate at a predetermined flow rate through the use of an integrated flow control orifice located within each filter cartridge outlet manifold. The media-filled cartridges shall trap particulates (TSS) and have the capability to adsorb pollutants such as dissolved metals, nutrients and hydrocarbons. The media cartridge filtration system shall consist of no less than 0.12 cubic feet of filter media for each 1-gallon per minute of water quality treatment flow.

1.3 The stormwater media cartridge filtration system shall be of a type that has been installed and in use for a minimum of five (5) consecutive years preceding the date of installation of the system. The manufacturer shall have been, during the same consecutive five (5) year period, engaged in the engineering design and production of systems deployed for the treatment of storm water runoff and which have a history of successful production, acceptable to the engineer of record and/or the approving jurisdiction.

1.4 Submittals:

A. The contractor shall submit to the city shop drawings for the stormwater media cartridge filtration system structure, filter cartridges and accessory equipment. Drawings shall include principal dimensions, filter placement, location of piping and unit foundation.

B. Contractor shall submit installation instructions to the city.

C. Contractor shall submit an operation and maintenance manual to the city.

1.5 Substitution: any proposed equal alternative product substitution to this specification must be submitted for review and approved by the engineer of record 10 days prior to bid opening. Review package should include third party reviewed performance data for both flow rate and pollutant removal. Pollutant data should follow tape protocols. The system must have a guld approval for basic treatment through the department of ecology.

1.6 American society for testing and materials (ASTM) reference specifications:

A. ASTM C857: standard practice for minimum structural design loading for underground precast concrete utility structures

B. ASTM C858: standard specification of underground precast concrete utility structures

C. ASTM C478: standard specification for circular precast reinforced concrete manhole sections

D. ASTM C497: standard test methods for concrete pipe, manhole sections or tile

E. ASTM C109: standard test method for compressive strength of hydraulic cement mortars

F. ASTM A615/A615m: standard specification for deformed and plain carbon-steel bars for concrete reinforcement

G. ASTM D698: standard test methods for laboratory compaction characteristics of soil using standard effort

H. ASTM F628: standard specification for ABS schedule 40 plastic drain, waste and vent pipe with a cellular core

I. ASTM D1785: standard specification for PVC plastic pipe, schedules 40, 80 & 120

J. ASTM D2466: standard specification for PVC plastic pipe fittings, schedule 40

K. ASTM A36: standard specification for carbon structural steel

L. ASTM A48: standard specification for gray iron castings

M. ASTM D4101: standard specification for polypropylene injection and extrusion materials

1.7 American association of state highway and transportation officials (AASHTO) reference specifications:

A. AASHTO M199: standard specification for precast reinforced concrete manhole sections

PART 2 - Materials

2.1 Internal components:

A. ABS manifold pipe shall meet ASTM f628. PVC manifold pipe shall meet ASTM D1785 and PVC fittings shall meet ASTM D2466.

B. Filter cartridge bottom pan, inner ring, and hood shall be constructed from linear low-density polyethylene (LLDPE) or ABS. Filter cartridge screen shall consist of 1" x ½" welded wire fabric (16 gauge minimum) with a bonded PVC coating. Internal parts shall consist of ABS or PVC material. Siphon-priming float shall be constructed from high-density polyethylene (HDPE). All miscellaneous nuts, bolts, screws, and other fasteners shall be stainless steel or aluminum.

C. An orifice plate shall be supplied with each cartridge to restrict flow rate to a maximum of 22.5 gpm at system design head or as specified on drawings.

D. If a sump cover/overflow, baffle/inlet, sump/outlet, sump/inlet, tower/outlet overflow is provided, they shall be constructed of ABS and sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, sikaflex 1a or equal. Contractor to provide sealant material and installation unless completed prior to shipment.

E. Where an underdrain design is provided, the size of the underdrain will provide a minimum of 0.067 in^2 of underdrain cross sectional area per 1 gpm of design flow rate. (example: 105 gpm maximum design flow rate will require an underdrain with 7.035 in^2 of cross sectional area, which is equal to one 3" diameter pipe).

F. Filter media shall consist of one or more of the following, as specified in the stormwater media cartridge filtration system data block, or by the engineer:

1. Perlite media: perlite media shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The perlite media shall have a bulk density ranging from 6.5 to 8.5 lb/ft^3 and particle sizes ranging from that passing through a 0.50 inch screen and retained on a U.S. standard #8 sieve.
2. CSF media: CSF media shall be made exclusively of composted fallen deciduous leaves. Filter media shall be granular. Media shall be dry at the time of installation. The CSF leaf media shall have a bulk density ranging from 40 to 50 lb/ft^3 and particle sizes ranging from that passing through a 0.50 inch screen to that retained on a U.S. standard #8 sieve.

3. Metal rx media: metal rx media shall be made exclusively of composted fallen deciduous leaves. Filter media shall be granular. Media shall be dry at the time of installation. The metal rx media shall have a bulk density ranging from 40 to 50 lb/ft^3 and particle sizes ranging from that passing through a U.S. standard #8 sieve to that retained on a U.S. standard #14 sieve.
4. Zeolite media: zeolite media shall be made of naturally occurring clinoptilolite, which has a geological structure of potassium-calcium-sodium aluminosilicate. The zeolite media shall have a bulk density ranging from 44 to 48 lb/ft^3, particle sizes ranging from that passing through a U.S. standard #4 sieve to that retained on a U.S. standard #6 sieve, and a cation exchange capacity ranging from 1.0 to 2.2 meq/g.
5. Granular activated carbon: granular activated carbon (GAC) shall be made of lignite coal that has been steam activated. The GAC media shall have a bulk density ranging from 28 to 31 lb/ft^3 and particle sizes ranging from that passing through a U.S. standard #4 sieve to that retained on a U.S. standard #8 sieve.
6. Zeolite-perlite-granular activated carbon (ZPG): ZPG is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% perlite (see above) and a 1.3 ft^3 inner layer consisting of a mixture of 90% zeolite (see above) and 10% granular activated carbon (see above).
7. Zeolite-perlite (zeo/perl): zeo/perl is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% perlite (see above) and a 1.3 ft^3 inner layer consisting of 100% zeolite.
8. CSF leaf media – granular activated carbon (CSF/GAC): CSF/GAC is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% CSF media (see above) and a 1.3 ft^3 inner layer consisting of 100% granular activated carbon (see above).
9. Perlite – metal rx : perlite/metal rx is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% perlite (see above) and a 1.3 ft^3 inner layer consisting of 100% metal rx (see above).
10. Phosphosorb: phosphosorb media shall be made from perlite pellets with activated alumina bound to the surface. The phosphosorb media pellets shall be granular and have a bulk density from 18 to 25 lb/ft^3. The pellet size should range from that passing through a U.S. standard ¼ inch sieve and retained on a #8 sieve.

G. Overflow assembly (where applicable):

1. Flow spreader shall be constructed of linear low-density polyethylene (LLDPE). Contractor to provide sealant material and installation unless completed prior to shipment.
2. Energy dissipater shall be constructed of polyolefins. Contractor to provide sealant material and installation unless completed prior to shipment.
3. Outlet riser with scum baffle shall be constructed of HDPE. Outlet riser shall have an outlet stub outside dimension (o.d.) of 12-inch diameter PVC, sdr 26 and a secondary outlet stub o.d. of 8-inch diameter PVC, sdr 26.

2.2 Steel catch basin & roof drain components:

A. Basin shall be all welded steel construction, fabricated from ASTM A36 ¼-inch steel and shall be designed to withstand AASHTO H-20 wheel loads when placed below ground in a location that could receive direct loading.

B. Basin grate: grating shall be ductile iron construction and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM a48.

C. Basin solid lid (below ground system design): solid lid shall be gray cast iron, treated with non-slip surfacing, and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.

D. Basin solid lid (above ground system design): solid lids shall be PVC plate with pick holes. Covers to be cut as required for top inlet roof drain pipes.

2.3 Precast concrete structure components:

A. Precast concrete vault shall be provided according to ASTM C857 and C858. Precast concrete manhole shall be provided according to ASTM C478.

B. Vault and manhole joint sealant shall be conseal cs-101 or approved equal.

C. If interior concrete baffle walls are provided, baffle walls shall be sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, sikaflex 1a or equal. Contractor to provide sealant material and installation unless completed prior to shipment.

D. Frames and covers shall be gray cast iron and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.

E. Doors shall have hot-dipped galvanized frame and covers. Covers shall have diamond plate finish. Each door to be equipped with a recessed lift handle. Doors shall meet H-20 loading requirements for incidental traffic, at a minimum, or per project specific traffic loading requirements.

F. Steps shall be constructed of copolymer polypropylene conforming to ASTM D4101. Steps shall be driven into preformed or drilled holes once concrete is cured. Steps shall meet the requirements of ASTM C478 and AASHTO M199. The ½” grade 60 deformed reinforcing bar shall meet ASTM A615, where required.

G. Ladders shall be constructed of aluminum and steel reinforced copolymer polypropylene conforming to ASTM D4101. Ladder shall bolt in place. Ladder shall meet all ASTM C497 load requirements. Ladders provided upon request or where required, and shall not conflict with the operation and accessibility to perform maintenance of the stormwater media cartiridge filtration system.

2.4 Contractor provided components:

A. All contractor-provided components shall meet the requirements of this section, the plans specifications and contract documents. In the case of conflict, the more stringent specification shall apply.

B. Sub-base: crushed rock base material shall be six-inch minimum layer of ¾-inch minus rock. Compact undisturbed sub-grade materials to 95% of maximum density at +/-2% of optimum moisture content. Unsuitable material below sub-grade shall be replaced to engineer's approval.

C. In-situ concrete, if required, shall have an unconfined compressive strength at 28 days of at least 3000 psi, with ¾-inch round rock, a 4-inch slump maximum, and shall be placed within 90 minutes of initial mixing.

D. Silicone sealant shall be pure rtv silicone conforming to federal specification number tt s001543a or tt s00230c or engineer approved.

E. Grout shall be non-shrink grout meeting the requirements of corps of engineers crd-C588. Specimens molded, cured and tested in accordance with ASTM C109 shall have minimum compressive strength of 6,200 psi. Grout shall not exhibit visible bleeding.

F. For manhole systems, contractor shall connect to 12-inch or 8-inch diameter outlet riser with fernco flexible coupling, or approved equal.

G. Rebar used on applicable catch basin & roof drain systems shall meet ASTM A615M grade 420 (60 ksi) or as otherwise specified in the general technical specifications.

H. Backfill material shall be ¾-inch minus crushed rock, or approved equal.

PART 3 - Performance

3.1 Cartridge operation: each stormwater media cartridge filtration system shall contain one or more siphon actuated media filter cartridges that maintain a uniform pressure profile across the face of the filter during operation. At the design flow rate the maximum filter hydraulic loading rate is not to exceed 2.1 gallons per minute per square foot of filter surface area. Stormwater shall enter the filter cartridges through sides and shall flow through the filter media radially from the outer perimeter to the inner cartridge lumen and shall have an average contact time no less than 38 seconds. These media filter cartridges will incorporate a self-cleaning mechanism to remove accumulated material from the cartridge media surface that is activated when the siphon breaks.

3.2 Documentation of sediment removal: the stormwater media cartridge filtration system system shall have the state of Washington department of ecology, general use level designation (guld) certification and current approval status from the new jersey department of environmental protection (njdep).

3.3 Cartridge sediment loading: filter cartridges shall be of a design that has demonstrated a minimum sediment retention capacity of 22 pounds of silty loam per cartridge in laboratory tests without a reduction in hydraulic capacity. Laboratory data shall be corroborated with field observations/data demonstrating equivalent or improved longevity without impacting normal hydraulic performance of the stormwater media cartridge filtration system. All laboratory and field tests submitted in support of this specification must have undergone peer review by outside entity other than Contech.

3.4 Overflow:

A. Vault configuration: stormwater media cartridge filtration system shall have a baffled, non-siphoning internal overflow with a minimum capacity of 1.8 cfs.

B. Manhole configuration: the filter system will have a baffled, non-siphoning internal overflow with a minimum of 1.0 cfs capacity.

C. Peak diversion configuration: each stormwater media cartridge filtration system shall include an internal, offline overflow bypass. Water first enters an inlet bay that is separate from the cartridge bay and separate from the outlet bay. Low flows travel from the inlet bay, through a transfer opening and into the cartridge bay. High flows enter the outlet bay by topping a weir separating the inlet and outlet bay. Flow rates beyond the treatment design flow shall bypass, and not enter the cartridge bay.

D. Catch basin configuration: each stormwater media cartridge filtration system shall include an internal, offline overflow bypass. Water enters through the grate into the inlet bay that is separate from the cartridge bay and separate from the outlet bay. Low flows travel from the inlet bay, through a transfer opening and into the cartridge bay. High flows enter the outlet bay by topping the baffled weir separating the inlet and outlet bay. Flow rates beyond the design flow (overflow) will not enter the cartridge bay. Minimum of 0.5 cfs overflow capacity.

E. Roof drain configuration: minimum of 1 cfs overflow capacity.

F. Infiltration manhole configuration: the filter system will have a baffled, non-siphoning internal overflow with a minimum of 1.0 cfs capacity.

3.5 Linear grade configuration vault access: all portions of the vault, inlet bay, outlet bay and filtration bay shall be directly accessible from the surface through removable grated openings or solid covers.

PART 4 - Execution

4.1 Precast concrete structure:

A. Set precast structure on crushed rock base material that has been placed in maximum 6-inch lifts, loose thickness, and compacted to at least 95-percent of the maximum dry density as determined by the standard proctor compaction test, ASTM D698, at moisture content of +/-2% of optimum water content.

B. Structure floor shall slope 1/4 inch maximum across the width and slope downstream 1 inch per 12 foot of length. For manholes “length” is defined by a line running from the invert of the outlet through the center of the manhole and “width” is the perpendicular to the “length”. Structure top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.

C. Inlet and outlet pipes shall be stubbed in and connected to precast concrete structure according to engineer’s requirements and specifications. All connections to be sealed to minimize water intrusion. If grout is used, contractor to grout all inlet and outlet pipes flush with or protruding up to 2 inches into interior of structure.

D. When required, ballast shall be placed to the dimensions specified by the engineer and noted on the data block. Ballast shall not encase the inlet and/or outlet piping. Provide 12” clearance from outside diameter of pipes.

4.2 Steel catch basin:

A. Catch basin floor shall slope 1/4 inch maximum across the width and slope downstream 1 inch per 12 foot of length. Catch basin top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.

B. Contractor shall prevent sediment and debris from entering the filter unit during construction.

C. If necessary, the inlet chamber may be filled with clean water to assist in preventing flotation during construction until the structure is backfilled and the concrete collar is poured.

D. Catch basin outlet shall be connected to downstream (and upstream, if applicable) piping using a flexible-type coupling.

E. Concrete perimeter slab shall be constructed 1 foot wide and 6 inches thick. Slab shall include two #4 rebar hoops with minimum 6-inch overlap at closure. Allow 2-inch vertical spacing between hoops and minimum 2-inch clearance from concrete surfaces, or as directed by the engineer.

4.3 Clean up:

A. Remove all excess materials, rocks, roots, or foreign material, leaving the site in a clean, complete condition approved by the engineer. The project site shall be clean and free of dirt and debris and the inlet/outlet chamber(s) and filter chamber(s) shall be free of construction debris and sediment before the allowing runoff to enter and place the system in operation. All filter components shall be free of any foreign materials including concrete and excess sealant.

B. Where applicable, contractor shall remove the temporary filter fabric around the inlet grate to place the system in operation.

C. Where required, the 4-inch cleanout plug in the overflow weir wall shall remain in place for proper operation of the system.

4.4 Filter cartridges:

A. Filter cartridges shall be delivered installed in the structure, unless otherwise agreed upon with Contech or the manufacturer. Contractor shall take appropriate action to protect the cartridges from sediment and other debris during construction. The method ultimately selected shall be at contractor's discretion and contractor's risk. Some methods for protecting the cartridges include, but are not limited to:

1. Remove cartridges from the structure and store appropriately. Cartridges shall be reinstalled to operate according to these specifications.
2. If structure is equipped with underdrain bypass piping, contractor may leave cartridges in the vault and allow stormwater entering collection system to bypass filter bay through underdrain bypass piping.
3. Leave cartridges in the structure and plug inlet and outlet pipe to prevent stormwater from entering the vault, and provide means for stormwater to bypass the stormwater media cartridge filtration system.

4.5 Filter cartridges shall not be placed in operation until the structure is clean and the project site is clean and stabilized (construction erosion control measures no longer required). The project site includes any surface that contributes storm drainage to the stormwater media cartridge filtration system. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of dirt and sediments. Contact Contech or the manufacturer to assist with system activation and/or inspect the system for proper installation once site is clean and stabilized.

4.6 Contractor to install filter cartridges. Specifications for alternate cartridge installation methods available by contacting Contech or the manufacturer directly.

A. *Filter cartridges with ¼-turn connector fittings:* tape shall be cleanly and completely removed from manifold fitting openings. ¼-turn connects shall be glued and inserted into all manifold fittings to be equipped with a filter cartridge. Filter cartridges shall be turned onto the connector until they reach the hard stop on the connector – approximately ¼ revolution, with care to not "over turn" the cartridge, or turn with such force to damage the hard stop mechanism. Plugs shall be inserted without glue in all manifold fittings not equipped with a filter cartridge.

PART 5 - Inspection and maintenance

5.1 Maintenance and inspection shall be in performed in accordance with the manufacturer's recommendations for maintenance and inspection.

5.2 Maintenance and inspection intervals shall be per the manufacturer's recommendations, or per the approving/local jurisdiction/agency requirements; whichever is more frequent.

5.3 Surface access for personnel and equipment for inspection and maintenance activities shall be provided.

End of section 33 40 20

SECTION 33 46 16
PLAYFIELD SUBSURFACE DRAINAGE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Coordinate work with sections 31 00 00 - Earthwork and 31 22 16 - Field Subgrade Establishment.

B. Furnish and install playfield drainage systems as indicated on the drawings.

C. The work includes systems incorporating trenched perforated drainage tubing and 12” width “flat” drainage tubing.

D. Trench to line and grade as shown on the drawings utilizing laser controlled equipment.

E. Dispose of excavated trench material or reuse as fill material on site.

F. Remove all loose material from collector and lateral trench bottom.

G. For round pipe perforated lateral drainage piping, place a minimum 2" depth of specified washed pea gravel bedding for perforated lateral piping.

H. Install perforated corrugated tubing in trenches that are cleanly and neatly lined with the approved soil structural fabric / non-woven geotextile.

I. Bed and backfill round perforated tubing trenches with specified washed pea gravel. Backfill over corrugated tubing in jump pits with pea gravel.

J. Upon completion of this work, restore subgrade to specified condition and tolerances, compacted to 95% density with no loose material on surface.

K. Furnish and install trench drain and trench drain catch basins around the perimeter of the playing field as shown on the plans.

1.2 STANDARD SPECIFICATIONS

A. American Public Works Association, Washington State Chapter, Standard Specifications for Municipal Public Works Construction (APWA) (latest edition).

B. Standard Specifications for Road, Bridge, and Municipal Construction, WSDOT, American Public Works Association (APWA)

C. United States Department of Agriculture, Soil Conservation Service, Engineering Standard 606.

1.3 RELATED WORK IN OTHER SECTIONS:

31 00 00	Earthwork
32 11 23	Synthetic Athletic Field Turf Base
32 17 23.28	Infilled Synthetic Turf System
33 40 00	Storm Drainage

1.4 SUBMITTALS

A. Submit the following for approval:

1. Pea gravel sieve analysis
2. Product data for perforated and non-perforated tubing
3. Product data for all fittings and connections

1.5 QUALIFICATIONS:

A. The Contractor qualifications responsible for the work in this section shall submit Owner's Representative qualification requirements as follows:

1. Contractor shall be and has been actively and directly engaged in constructing similar synthetic field projects for a period of five (5) or more years and shall provide proof of five (5) or more full size (minimum 75,000 SF) field base installations completed in the past five (5) years.
2. The Contractor's experience shall include completion of high school or collegiate competition fields, or professional level practice or competition fields. The qualifying playing field systems shall include earthwork, washwater or irrigation systems, drainage and subsurface drainage systems and base aggregate placement and compaction.

PART 2 - PRODUCTS

2.1 PERFORATED AND NON-PERFORATED TUBING

A. The piping shall be corrugated polyethylene drainage tubing. The perforated and non-perforated collector tubing shall be smooth interior wall CPEP.

B. Material shall conform to requirements of Type III, Grade 4, Class "C" polyethylene as specified in ASTM D1248.

C. Dimensions:

1. Inside diameter variance shall not exceed -0.0% or +5%.
2. Lengths shall be in coiled configuration with a -0.0% tolerance.

D. Tubing shall conform to U.S. Department of Agriculture Soil Conservation Service, Engineering Standard 606.

E. Perforated tubing:

1. For round pipe, utilize single wall, perforated drainage tubing. Water inlet areas shall be slotted with a width of 1/16" "0.020" to a maximum of 3/32" "0.030" uniformly spaced circumferential slots located on the inner depression of the corrugation, totaling a minimum of 1.25 square inches per lineal foot. The perforations shall provide a clear opening. Tubing with perforations that are punched with a flap type opening or that are not uniform will be rejected.
2. For Flat Drainage Tubing, ADS "AdvanEdge" system and all necessary pre-molded fittings, couplers, and caps.

F. Fittings and Connections:

1. Fittings shall be as furnished by the manufacturer of the pipe.
2. Connections of tubing lengths shall be with split coupling or snap-in-type couplings utilizing polyethylene or construction tape.
3. Tubing is to be inserted into sockets for the full socket length. "Slip-fit" connections will not be permitted.
4. All split coupling connections are to be fully taped. All connections at fittings and connections are to be taped at interface of exposed joint.

2.2 PEA GRAVEL:

A. Pea-gravel bedding and backfill for perforated pipe subdrainage systems, and as backfill for un-piped infiltration trenches, shall be clean, washed, uniformly graded 3/8" to 1/8". The pea gravel material graduation must meet the following sieve analysis:

Sieve Size	Percent Passing
1/ 2"	100
3/ 8"	80 - 100
# 4	0 - 50
# 8	0 - 10
# 100	0 - 0.6
# 200 (wet sieve)	0 - 0.5
# 270 (wet sieve)	0 - 0.3

2.3 TESTING

A. The Owner will perform testing of materials delivered to the job site for the purpose of verifying compliance with the contract documents. The Owner's testing is for this purpose only and not for construction quality control by the Contractor.

B. The Contractor shall coordinate directly with the Owner's testing firm relative to the delivery schedules of the imported materials.

C. The Contractor shall provide testing and surveillance as required to assure materials and work fully comply with contract requirements.

D. The Contractor at a price equal to the Owner's contract testing agreement shall pay for owner's tests that do not meet specifications. The Contractor shall pay directly to the testing organization upon invoice to the owner, which has been approved by the Owner's Representative.

PART 3 - EXECUTION

3.1 TRENCHING

A. Coordination: It is the responsibility of the Contractor to ensure that electrical conduits and wash water piping are installed at a sufficient depth below subgrade before the trenching for the subsurface drainage system to avoid conflicts between systems.

B. Excavation shall be made to the alignment, elevation, grade and slope as indicated on the drawings.

C. Trenching shall be accomplished utilizing equipment with slope and depth control so as to ensure accuracy in the bottom of the trench.

D. No high points above designated invert or calculated trench bottom elevation will be permitted. No sloughing of site material or loose excavated soil will be permitted to remain in the trenches.

E. Surplus excavated soil shall be removed from the field area. Excavated material may not remain on subgrade. Excess soil material shall be disposed of off-site or, per approval by the Owner, in the project work area.

F. Provide a smooth, even subgrade after removal of the trench material. Subgrade to be compacted to 95% density. Leave no loose material on the subgrade.

3.2 PLACEMENT

A. Excavate below invert grade to provide depth for specified placement of pea gravel bedding prior to laying the tubing.

B. Pea-gravel bedding for perforated pipe shall comply with material specifications above.

C. No foreign material will be permitted inside, alongside, under, or on top of, installed tubing.

D. All joints and connections shall be with manufacturers snap type fittings and taped secure.

E. Coordinate installation of structural soil bearing fabric to be continuous through trenches, however never placed over the surface of the pipe.

F. For round pipe perforated lateral drainage piping, place a minimum 2" depth of specified washed pea gravel bedding for perforated lateral piping.

3.3 BACKFILL

A. Collector Tubing:

1. For non-perforated collector under 12” in diameter, install corrugated polyethylene (CPEP) collector tubing. Backfill with select site soil, 8" maximum lifts, compacted to 95%.
2. For perforated collector, install corrugated polyethylene (CPEP) collector tubing. Bed and backfill with pea gravel.

B. All trenches to have backfill material "crowned" a minimum of 2" above subgrade to protect from foreign material and provide for ease of location identification. Crowns with foreign material contamination shall be removed prior to placement of base aggregate.

C. Specified bedding shall not be placed until Owner’s Representative approves the trench.

D. Trench backfill shall not be placed before Owner’s Representative approves perforated pipe placement.

E. During placement of specified trench backfill, pipe must be held in place with a hand device to prevent displacement and provide for achieving specified invert elevation. Do not damage pipe or allow pipe to be displaced by placement of backfill material.

3.4 CONNECTIONS

A. Includes all new work and connection to existing subdrainage pipe.

B. All connections are to be made with approved fittings per the tubing manufacturer and approved by the Owner’s Representative.

C. Tubing is to be inserted into sockets for the entire length. Tape all connections utilizing polyethylene or construction tape. Tape alone shall not be acceptable when connecting separate pieces of pipe together.

D. No foreign material will be permitted inside the installed tubing.

E. Cap the ends of all lateral runs as shown on the drainage plan. All open ends during construction are to be temporarily capped or plugged. Tape shall not be used in lieu of end caps.

F. Connection of laterals to collector drains shall be made with a combination reducing tee and reducing saddle tee or end tee as applicable, utilizing snap connections.

3.5 EQUIPMENT MOVEMENT

A. No trucks or equipment will be allowed to drive over the top of the trenches except track-equipped machinery utilized in spreading imported granular materials. Backfilled trenches are to be staked and "flagged" 3' above grade a maximum 20' spacing for identity.

END OF SECTION

SECTION 33 46 16.19

PIPE UNDERDRAINS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered in this Section includes installation of 12-inch oblong corrugated pipe for use in subsurface drainage applications

1.2 REFERENCES

A. King County Road Design and Construction Standards (2016)

1. City of SeaTac Addendum to Road Standards (2020)
2. WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (2023)
3. Geotechnical Report, included in the Appendix to these specifications

1.3 SUBMITTALS

A. Submit the following Project Data for all materials used:

1. Brochures and catalog cuts
2. Product technical data showing that the product meets the requirements of the standards referenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall confirm to:

1. Product must have annular interior and exterior corrugations
2. ASTM D7001
3. Outside dimensions shall be 1.5” thick x 12.5” wide
4. Internal bracing adjoining each long wall to prevent crushing under typical loading.
5. Shall be made available with or without an external geotextile wrap. When geotextile is provided, product shall meet the requirements of Class B Geocomposite as defined in ASTM D7001.

6. All pipe and fittings shall be made of polyethylene with a minimum cell classification of 424420C as defined and described in the latest version of ASTM D3350.

Perforations

Nominal Pipe Size, in	12
Slot Length (avg), in	1.125
Slot width (avg), in	0.125
Water inlet area (approx..), in^2/ft	15

Filter Fabric

Fabric Properties	Test Method	Minimum Average Roll Values
Grab Tensile Strength (lbs) – weakest principle direction	ASTM D4632	112
Grab elongation (%) – weakest principle direction	ASTM D4632	50
Trapezoidal Tear (lbs) – weakest principle direction	ASTM D4533	40
Puncture (lbs)	ASTM D4833	40
Permittivity (sec^{-1})	ASTM D4491	0.5
AOS (U.S. Sieve Size)	ASTM D D4751	60
U.V. Resistance	ASTM D 4355	50

END OF SECTION 33 46 16.19