Menefee
Architecture

ROME TENNIS – INDOOR COURTS

100% DESIGN DEVELOPMENT SUBMISSION

November 20th, 2018

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SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Rome Tennis- Indoor Courts

B. Owner's Name: City of Rome.

C. Architect's Name: Menefee Architecture.

D. The Project consists of the construction of a premanufactured metal building housing indoor tennis courts and associated site work.

1.02 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings.

B. Scope of alterations work is shown on drawings.

C. Scope of new construction and associated site work is shown on the drawings.

D. Owner will remove the following items before start of work:
   1. Nets and net posts.
   2. Seating and other site furnishing.
   3. Windscreen.

E. Contractor shall remove and deliver the following to Owner prior to start of work:
   1. Light poles.
   2. Fencing.

F. Contractor shall remove and store the following prior to start of work, for later reinstallation by Contractor:
   1. Scoreboards.

1.03 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. some items may include
   1. Audio Visual Equipment
   2. Furnishings.
   3. Small equipment.
   4. Fixed Wall Graphics.

B. Owner will supply and install the following:
   1. Audio Visual Equipment.

1.04 OWNER OCCUPANCY

A. Owner intends to occupy all existing Tennis Courts (with the exception of those being covered by the proposed indoor facility), the Clubhouse, the North Pavilion, and parking lots. CM to gain prior approval for any activiites impacting Owner's use of these facilities.

B. Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner use of complex.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings

B. Arrange use of site and premises to allow:
   1. Owner occupancy and access to adjacent facilities.
   2. Work by Others.
   3. Work by Owner.
   4. Use of site and premises by the public.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit and written authorization by the Owner and City.

D. Time Restrictions:
   1. Limit conduct of especially noisy, malodorous, and dusty exterior work to per Owner's written requirements. _____.

E. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the site is unoccupied. Arrange all shutdowns at least 72 hours in advance with Owner.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 50 00 - Contracting Forms and Supplements: Forms to be used.

B. Section 01 21 00 - Allowances: Payment procedures relating to allowances.

C. Section 01 22 00 - Unit Prices: Monetary values of unit prices, payment and modification procedures relating to unit prices.

D. Section 01 23 00 - Alternatives.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit a printed schedule on AIA Form G703 Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify bonds and insurance.

F. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

H. Revise schedule to list approved Change Orders, with each Application For Payment. Do not alter original values for line items.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.

9. Balance to Finish.
10. Retainage.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

H. Submit three copies of each Application for Payment.

I. Include the following with the application:
1. Transmittal letter as specified for Submittals in Section 01 30 00.
2. Construction progress schedule, revised and current as specified in Section 01 30 00.
3. Interim lien waivers for all major Subcontractors and Vendors. Submit original notarized form, photo copies will not be accepted.
4. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
5. Affidavits attesting to off-site stored products.

J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.

B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications. . Contractor shall prepare and submit a fixed price quotation within 10 days.

E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

G. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide the following data:
a. Quantities of products, labor, and equipment.
b. Taxes, insurance, and bonds.
c. Overhead and profit.

d. Justification for any change in Contract Time.
e. Credit for deletions from Contract, similarly documented.

2. Support each claim for additional costs with additional information:
   a. Origin and date of claim.
   b. Dates and times work was performed, and by whom.
   c. Time records and wage rates paid.
   d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Contractor will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR SUBSTAINTIAL COMPLETION

A. Prepare Application for Substantial Completion in accordance with the Contract and General Conditions.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts, less cost of delivery to site, less applicable taxes.

B. Costs Not Included in Cash Allowances: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.

C. Architect Responsibilities:
   1. Consult with Contractor for consideration and selection of products .
   2. Select products in consultation with Owner and transmit decision to Contractor.

D. Contractor Responsibilities:
   1. Assist Architect in selection of products, suppliers, and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Change Order.

1.04 ALLOWANCES SCHEDULE

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED

A. Unit Prices shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 UNIT QUANTITIES SPECIFIED

1.04 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Assist by providing necessary equipment, workers, and survey personnel as required.

C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

D. Measurement by Area: Measured by square dimension using mean length and width or radius.

E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

1.05 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected Products.

1.06 DEFECT ASSESSMENT

A. Replace Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:
   1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect.
   2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.

C. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct one of the following remedies:
   1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Owner.
   2. The defective Work will be partially repaired to the instructions of the Owner, and the unit price will be adjusted to a new unit price at the discretion of Owner.

D. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.

E. The authority of Owner to assess the defect and identify payment adjustment is final.

1.07 SCHEDULE OF UNIT PRICES

A. Item: Excavation and Haul Off of Unsuitable Soils.

B. Item: Import and Placement of Controlled Structural Fill.

C. Item: Rock Removal - Mass Rock and Trench Rock.

D. Item: Concrete - Provide and place.

E. Item: #57 Stone - Provide and place.

F. Item: Court Surface - Provide and place.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Price and Contract Time.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Building Conditioning:

1. Provide ground mounted roof top unit outside proposed indoor facility(at the west end). Run duct vertically up the outside of the building and turn horizontal to enter the building under the ridge line. Transition to two 30" fabric duct routed parallel across the center of the building coming off a common Y-connection under the ridge.
2. 40 Tons - 16,000 CFM

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Progress photographs.

E. Submittals for review, information, and project closeout.

F. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

B. Section 01 78 00 - Closeout Submittals: Project record documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. subcontractors as appropriate for initial scope.

B. 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 to Contract, owner and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-weekly intervals.

B. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's Superintendent.
   5. Major Subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.

2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS

A. Submit new photographs at least once a month, within 5 days after exposure.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

E. Views:
   1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.

F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in.pdf format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

B. Transmit each submittal with a copy of approved submittal form.

C. Transmit each submittal with approved form.

D. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

E. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

G. Design Team will not review any submittal without Contractor's stamp affixed.

H. Schedule submittals to expedite the Project, and coordinate submission of related items.

I. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

J. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

K. Provide space for Contractor and Architect review stamps.

L. When revised for resubmission, identify all changes made since previous submission.

M. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

N. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 33 30
STRUCTURAL SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural submittals include shop drawings, design calculations, diagrams, illustrations, schedules, performance charts, nomenclature charts, samples, brochures and other data prepared by the Contractor or any subcontractor, manufacturer, supplier, fabricator, or distributor and which illustrate some portion of the Project.

B. Submittals by the Contractor are not a part of the Contract Documents.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals.

1.03 SUBMITTAL PROCEDURES

A. Prior to the initial submittal, Contractor shall submit to the Design Professional a completed *Submittal Information and Schedules* form given in Appendix I.

B. Submittals shall be accompanied by a transmittal letter with the following information:
   1. Project name.
   2. Contractor's name.
   3. Date submitted.
   4. Specification section of work/product submitted.
   5. Description of items submitted.
   6. Number of drawings and other pertinent data.

C. Provide black space on each submittal for the Design Professional's review stamp.

D. Contractor shall direct specific attention on the submittal to any deviation from the contract documents.

1.04 CONTRACTOR RESPONSIBILITY

A. Contractor shall make all submittals in advance of installation or construction to allow the Design Professional sufficient time for review.

B. Contractor shall stamp and sign each sheet of shop drawings and product data, and sign or initial each sample to certify compliance with requirements of Contract Documents. SUBMITTALS RECEIVED WITHOUT THE CONTRACTOR'S STAMP OF REVIEW WILL BE RETURNED TO THE CONTRACTOR FOR REVIEW AND RESUBMITTAL.

C. Contractor shall understand that the submittal of the required documents does not constitute compliance with the requirements of the Contract Documents; only submittals reviewed by the Design Professional constitute compliance.

D. It is the Contractor's responsibility to furnish equipment, materials, and labor for the Project which meets the requirements of the codes and authorities quoted as well as the Contract Documents. Proprietary items specified herein only establish a minimum functional and aesthetic standard and it is incumbent upon the Contractor to ascertain conformance of these proprietary items or any proposed substitution with the codes and authorities.

E. By reviewing, approving and submitting shop drawings, product data, or samples, Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, member sizes catalog numbers, and similar data and that he has checked and coordinated shop drawings with the requirements of the Project and of the Contract Documents.

F. Work requiring shop drawings, whether called for by the Contract Documents or requested by the Contractor, shall not commence until the submission has been reviewed by the Design Professional. Work may commence if the Contractor verifies the accuracy of the Design Professional's corrections and notations and complies with them without exception and without requesting change in Contract Sum or Contract Time.

1.05 **DESIGN PROFESSIONAL REVIEW**

A. Design Professional will review submittals with reasonable promptness.

B. Design Professional's review or corrections refer only to the general arrangement and conformance of the subject of the submittals with the design concept of the project and with the information given in the Contract Documents. Under no conditions should the Contractor consider the review to include the dimensions of the items, the quantities of the items, the details of the items, nor the approval of an assembly in which the item functions.

C. Design Professional's review shall not relieve the Contractor from responsibility for errors or omissions in the submittals.

D. Design Professional's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has directed specific attention to the deviation at the time of submission and the Design Professional has given written approval to the specific deviation.

E. Design Professional's review of submittals shall not be construed as authorizing any change in the Contract Sum or Contract Time.

1.06 **SHOP DRAWINGS**

A. Present information in a clear and thorough manner. Title each drawing with Project name and number; identify each element of drawings by reference to sheet number and detail of Contract Documents.

B. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.

C. Identify field dimensions; show relationship to adjacent or critical features of Work or products.

D. A copy of the marked structural shop drawings with the Design Professional's review stamp is to be maintained at the job site.

1.07 **PRODUCT DATA**

A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information which is not applicable.

C. Provide manufacturer's preparation, assembly, and installation instructions.

1.08 **RESUBMITTALS**

A. When submittals are returned to the Contractor with the Design Professional's corrections the Contractor shall make the required corrections. Upon request, resubmit one corrected set.

B. Contractor shall direct specific attention on the resubmittal to all revisions including those requested by the Design Professional on previous submission.

1.09 **DISTRIBUTION**

A. Distribute reproductions of shop drawings, copies of product data, and samples which bear the Design Professional's review stamp to job site file, Record Documents file, subcontractors, suppliers, other affected contractors, and other entities requiring information.

B. Work shall be in accordance with and performed from the reviewed drawings.

PART 2 - **PRODUCTS**

Not Used.

PART 3 - **EXECUTION**

Not Used.

END OF SECTION

APPENDIX I

SUBMITTAL INFORMATION AND SCHEDULES

PROJECT: _____

CONTRACTOR _____

CONTRACTOR'S ADDRESS _____

_____

PROJ. MANAGER _____ PHONE _____ FAX _____

SUPERINTENDENT _____ PHONE _____ FAX _____

MOBILIZATION DATE _____

FOUNDATION, CONCRETE & REINFORCING		STRUCTURAL STEEL		MASONRY	
SUBMITTAL	DATE	SUBMITTAL	DATE	SUBMITTAL	DATE
Site Preparation & Equipment Information		Fabricator/Erector Qualifications		Grout & Mortar Mix	
Concrete Mix Design		Anchor Bolt & Embedded Items		Block Prism & Compression Strength	
Foundation Reinforcing		Erection & Detail Drawings		Reinforcing	
Structural Frame Reinforcing				Written Procedures	
Miscellaneous Frame Reinforcing		Joists		WOOD	
Post Tensioning		Deck		SUBMITTAL	DATE
Precast		Cooling Tower, Elevator & Stair Drawings		Trusses	

Remarks

COMPLETED BY _____ DATE _____

END OF APPENDIX I

APPENDIX II

SEISMIC SUBMITTAL INFORMATION

1.01 PREFACE

A. Items of equipment incorporated in, and installed in or on the building shall be fabricated and installed to resist vertical loads and lateral forces stated in the International Building Code, 2012 Edition.

B. Project is located in Seismic Zone X.
**** OR **** **** OR **** **** OR ****
Project is located in seismic hazard zone with site acceleration coefficients as follows:
1. Av = xxxx.
2. Aa = xxxx.

1.02 SUBMITTAL DATA REQUIRED

A. In order to provide adequate information to the Owner for proper review and evaluation of adequacy of equipment and non-structural items, submit the following information with shop drawings and product data.
1. Certificate from the manufacturers stating that the items furnished by them will maintain unit integrity by resisting lateral forces using the appropriate code required coefficients.
2. Dimensions and details of each piece of equipment, weight of each piece, and its approximate center of gravity.
3. Size and dimensions of supporting assembly structures and the identification of each of its members including secondary elements used as stiffeners and connectors.
4. Calculations prepared and signed by a licensed structural engineer in the Project state to indicate the adequacy of the structures to resist the code mandated vertical loads and lateral forces.

1.03 POSSIBLE BACK CHARGES TO CONTRACTOR

A. If the submittals for equipment and non-structural elements do not contain the data required, they will be returned without action for resubmission with required data. If the submittals are returned to Owner with incomplete or insufficient data which may cause extra work to the Owner or his consultants, the Owner will charge the Contractor for such extra work at the rate of 2.5 times direct personnel expense plus the cost of direct expenses.

END OF APPENDIX II

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Control of installation.

D. Tolerances.

E. Testing and inspection services.

F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

B. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

C. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

D. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION

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

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

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

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

2.03 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Attend preconstruction meetings and progress meetings.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

2.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, test, adjust and balance of equipment and roof inspection as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

2.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 45 25

STRUCTURAL TESTING/INSPECTION AGENCY SERVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section summarizes the responsibility of the Contractor and the Structural Testing/Inspection Agency in the performance of the testing/inspection specified in the Contract Documents.

B. Neither the observation of the Design Professional in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Design Professional shall relieve the Contractor from his obligation to perform the work in accordance with the Contract Documents.

1.02 RELATED SECTIONS

A. Section 01 33 30 – Structural Submittals.

B. Section 01 40 00 – Quality Requirements.

1.03 REFERENCES

A. ASTM D3740 – Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ASTM E329 – Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

C. American Council of Independent Laboratories – Recommended Requirements for Independent Laboratories Qualifications.

1.04 SELECTION AND PAYMENT

A. Owner will employ and pay for the structural testing/inspection services that are required by the Contract Documents.

B. Contractor shall pay for any additional structural testing/inspection required for work or materials not complying with Contract Documents due to negligence or nonconformance.

C. Contractor shall pay for any additional structural testing/inspection required for his convenience.

1.05 STRUCTURAL TESTING/INSPECTION REQUIREMENT SUMMARY

A. Specific structural testing/inspection requirements are given in the following specification sections:
   1. Specification 03 10 00 – Concrete Formwork Inspection.
   2. Specification 03 20 00 – Concrete Reinforcement Inspection.
   3. Specification 03 30 00 – Concrete Testing/Inspection.
   4. Specification 03 62 00 – Non-Shrink Grout Inspection.
   5. Specification 04 22 00 – Masonry Testing/Inspection.
   6. Specification 31 23 01 – Excavating, Backfilling, and Compaction For Structures.

1.06 STATEMENT OF SPECIAL INSPECTIONS

A. Provide testing/inspection required to meet the provisions of the Schedule of Special Inspection Services below.

PART 2 - PRODUCTS

NOT USED.

PART 3 - **EXECUTION**

3.01 STRUCTURAL PRECONSTRUCTION MEETING

A. A structural preconstruction meeting may be conducted at the construction site by the Design Professional to discuss quality issues. The parties involved may be the Design Professional, Contractor, Structural Testing/Inspection Agency, appropriate subcontractors, suppliers, and detailers.

3.02 STRUCTURAL TESTING/INSPECTION AGENCY'S RESPONSIBILITIES

A. Cooperate with the Contractor and provide timely service.

B. Upon arriving at the construction site, sign in and notify the Contractor of presence.

C. Select the representative samples that are to be tested/ inspected.

D. Perform tests/ inspections as outlined in Contract Documents, the applicable codes, and as directed by the Design Professional.

E. Report work and materials not complying with Contract Documents immediately to the Contractor and Design Professional.

F. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of Contractor's representative informed, type and location of work or materials tested/inspected, whether the work or materials complies with Contract Documents and name of the Structural Testing/Inspection Agency's representative.

G. Report and distribute results of tests/inspections promptly in the form of written reports as directed by the Design Professional.

H. Structural Testing/Inspection Agency shall not alter requirements of Contract Documents, approve or reject any portion of the work, or perform duties of the Contractor.

I. Submit Final Report of Special Inspections documenting required special inspections and correction of any discrepancies noted in the inspections to the Contractor and Design Professional.

3.03 CONTRACTOR'S RESPONSIBILITIES

A. Provide copy of Contract Documents to the Structural Testing/Inspection Agency.

B. Arrange the preconstruction meeting to discuss quality issues.

C. Notify the Structural Testing/Inspection Agency sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.

D. Cooperate with Structural Testing/Inspection Agency and provide access to work.

E. Provide samples of materials to be tested in required quantities.

F. Furnish copies of mill test reports when requested.

G. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples.

H. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/inspections.

3.04 OPTIONS

A. If the Structural Testing/Inspection Agency is located at such a distance from the project that travel expenses will be a consideration, or if the amount of sampling performed is minor, and by mutual agreement of the Design Professional and Contractor, the Contractor may be requested to take samples and forward them to the Structural Testing/Inspection Agency for testing/inspection.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power , consisting of access to existing facilties for connection by contractor.
   2. Water supply, consisting of access to existing facilities for connection by contractor.

B. Existing facilities may not be used.

C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Telephone Land Lines: One line, minimum; one handset per line.
   3. Internet Connections: Minimum of one; DSL modem or faster.
   4. Email: Account/address reserved for project use.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

E. Traffic Controls: when required to to maintain safety.

1.06 FENCING

A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

B. Provide Black Windscreen on all vertical fence surfaces.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.09 WASTE REMOVAL

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.10 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction as agreed to by Architect and Owner.

B. Erect on site at location approved by Owner.

C. No other signs are allowed without Owner permission except those required by law.

1.11 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rackand drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate ten persons.

C. Locate where approved in advance by owner.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 3 feet (____ mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements: Product quality monitoring.

B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
   1. See 02 41 00 Demolition for list of items required to be salvaged for reuse and relocation.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Where all other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 61 16.
   2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.
   4. Have longer documented life span under normal use.
   5. Result in less construction waste.
   6. Are made of vegetable materials that are rapidly renewable.
   7. Have a published GreenScreen Chemical Hazard Analysis.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Architect will consider requests for substitutions only within 15 days after date of issuance of GMP documents for CM bidding.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. A request for substitution constitutes a representation that the submitter:
   1. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure (after contract award):
   1. Submit electronic copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit side by side comparison of specified product with proposed substitution.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

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

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

D. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

E. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
   1. Minimum of five years of documented experience.

B. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

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

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. See Section 01 10 00 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. 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.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

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

C. Meetings shall occur during regularly scheduled OAC meetings.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations, and _____.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.

F. Protect existing work to remain.
1. Perform cutting to accomplish removals neatly and as specified for cutting new work.
2. Repair adjacent construction and finishes damaged during removal work.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

C. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

D. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.

B. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

E. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 10 00 for list of items to be salvaged from the existing building for relocation in project or for Owner.

B. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.

D. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

E. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect _____.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
   4. Comply with Spelman College closeout requirements if more stringent than above.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   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 in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractorand subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Operation and maintenance data.
      c. Field quality control data.
      d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements including outdoor courts, fencing, and pavement - refer to drawigns.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Sequencing and staging requirements.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 31 00 02 - Site Demolition.

H. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.

I. Section 31 22 00 - Earthwork

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of 5 years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of outdoor courts a as required for new construction.
   1. Owner intends to use all of the tennis courts, other than the 3 impacted by new construction, the Clubhouse, the Pavilion, and parking for the project duration unless temporary closure is required by the CM.
   2. Chalk lines and accurately sawcut for footing excavation.

3. Protect all foundation excavations from water accumulation and soil saturization to prevent undermining of court edge.
4. Protect existing courts to remain with overlayment of carpet and plywood.
   a. Remove portions of existing buildings in the following sequence:
   b. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill per contract requirements.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   7. Do not close or obstruct roadways or sidewalks without University prior written approval.
   8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Protect existing structures and other elements that are not to be removed.

C. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

E. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

F. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 01 74 19 - Waste Management.
   2. Dismantle existing construction and separate materials.
   3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section includes the design and erection of formwork, shoring and reshoring for cast-in-place concrete and accessories.

1.02 RELATED SECTIONS

A. Section 01 33 30 – Structural Submittals.

B. Section 01 45 25 – Structural Testing/Inspection Services.

C. Section 03 20 00 – Concrete Reinforcement.

D. Section 03 30 00 – Cast-in-Place Concrete.

1.03 REFERENCES

A. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 – Standard Specifications for Structural Concrete.

C. ACI 318 – Building Code Requirements for Structural Concrete.

D. ACI 347 – Recommended Practice for Concrete Formwork.

E. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

F. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.04 SUBMITTALS

A. Submit locations of construction joints for approval.

B. Submit manufacturer's data for waterstops, formwork accessories, inserts, form release agent, and isolation joint filler.

C. Submit manufacturer's data for carton void forms.

1.05 DESIGN OF FORMWORK

A. Design of formwork, shoring, and reshoring and its removal is the Contractor's responsibility.

B. Design of formwork, shoring, and reshoring shall conform to ACI 117, ACI 301, ACI 318, and ACI 347.

C. Design formwork in a manner such that existing or new construction is not overloaded.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Construct forms with wood, plywood, metal, fiberglass or a combination of these.

B. Form materials shall have sufficient strength to prevent distortion.

2.02 FORMWORK ACCESSORIES

A. Formwork accessories that are embedded in concrete, including ties and hangers, shall be commercially manufactured products. Do not use nonfabricated wire form ties.

2.03 FORM RELEASE AGENT

A. Form release agent shall not bond with, stain, nor adversely affect concrete surfaces.

2.04 WATERSTOPS

A. Waterstops at construction joints and control joints indicated by the Drawings shall be sized to suit the joints.

B. Waterstops shall be flat dumbbell type or center bulb type at control joints where shown on drawings.

C. Waterstops shall be pre-formed plastic adhesive waterstops at cold joints in concrete where shown on drawings.

1. Rectangular adhesive waterstops shall be provided for walls 8-inches thick or wider and have two layers of reinforcing. Waterstops shall have a minimum of 3” concrete cover.
2. Triangular or Trapezoidal adhesive waterstops shall be provided for walls 6-inches thick or wider with one-layer of reinforcing. Waterstop shall have a minimum of 2” concrete cover.

2.05 DOVETAIL ANCHORS

A. Dovetail anchors shall consist of 24 gage galvanized steel dovetail anchoring slots with filler strips and 16 gage galvanized dovetail anchors, unless otherwise noted on Drawings.

2.06 VAPOR BARRIER

A. Vapor barrier shall consist of polyethylene sheet, not less than ten mils thick.

2.07 ISOLATION JOINT FILLER

A. Asphalt impregnated premolded fiberboard isolation joint filler shall conform with ASTM D1751 and be 1/2-inch thick by full thickness of slab or joint, unless indicated otherwise on the Drawings.

2.08 CONSTRUCTION JOINTS

A. Provide key type steel forms by Vulcan screed joints, Burke Keyed Kold joint form or Form-A-Key.

PART 3 - EXECUTION

3.01 GENERAL

A. Erect formwork in accordance with ACI 301, ACI 318, and ACI 347.

B. Maintain formwork and shoring to support loads until such loads can be supported by concrete structure.

3.02 TOLERANCES

A. Finished work shall comply with ACI 117 tolerances.

3.03 SURFACE PREPARATION

A. For concrete exposed to view, seal form joints to prevent leakage.

B. Before reinforcement is placed, coat contact surfaces of form with form release agent in accordance with manufacturer’s recommendations. Do not allow excess form release agent to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.

3.04 CHAMFERS

A. Provide 3/4-inch chamfer at all corners.

3.05 FOUNDATION ELEMENTS

A. Form foundation elements if soil or other conditions are such that earth trench forms are unsuitable.

B. Sides of the following foundation elements shall be formed:

1. Exterior grade beams.
2. Foundation walls.
3. Turned-down slabs.

C. Maintain minimum coverage of reinforcing steel as indicated on Structural Drawings.

3.06 INSERTS

A. Install and secure in position required inserts, hangers, sleeves, anchors, and nailers.

B. Locate anchor bolts by using templates with two nuts to secure in position.

3.07 EMBEDS

A. Set and secure embedded plates, bearing plates, and anchor bolts in accordance with approved setting drawings and in such a manner to prevent displacement during placement of concrete.

3.08 DOVETAILS

A. Install continuous vertical dovetail anchoring slots with filler strips at intersections of concrete and masonry walls unless indicated otherwise by the Drawings.

3.09 VAPOR BARRIER

A. Where indicated on Drawings, place vapor barrier over sewer, piping, and granular subbase, but below conduits and ducts, and behind insulation and expansion joints at sidewalls.

B. Lap vapor barrier six inches minimum at splices.

C. Do not puncture vapor barrier.

3.10 FORM REMOVAL

A. Remove forms carefully in such manner and at such time as to ensure complete safety of structure. Do not remove forms shoring, or reshoring until members have acquired sufficient strength to support their weight and the load thereon safely.

3.11 PROVISIONS FOR OTHER TRADES

A. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings and recesses from trades providing such items.

B. Accurately place and securely support items built into forms. Obtain approval for openings not shown on Drawings.

3.12 CLEANING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

3.13 FORM SURFACES

A. Coat contact surfaces of forms with a formcoating compound before reinforcement is placed. Apply in accordance with manufacturer's recommendations. Rust-stained steel formwork is not acceptable.

3.14 CONSTRUCTION JOINTS

A. Provide construction joints in accordance with ACI 318.

B. Obtain Design Professional's prior approval for use and location of joints.

C. Provide 1-1/2 inch deep key type construction joints at end of each placement for slabs, beams, walls, and footings. Bevel forms for easy removal.

D. Remove loose particles and latency from surface prior to placing the next lift. Chip the surface to a depth sufficient to expose sound concrete.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 - **GENERAL**

1.01 SECTION INCLUDES

A. Section includes steel reinforcement and accessories for cast-in-place concrete work and concrete masonry

1.02 RELATED SECTIONS

A. Section 01 33 30 – Structural Submittals.

B. Section 01 45 25 – Structural Testing/Inspection Agency Services.

C. Section 03 10 00 – Concrete Formwork.

D. Section 03 30 00 – Cast-in-Place Concrete.

1.03 REFERENCES

A. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 – Standard Specifications for Structural Concrete.

C. ACI 315 – Details and Detailing of Concrete Reinforcement.

D. ACI 318 – Building Code Requirements for Structural Concrete.

E. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

F. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

G. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

H. AWS D12.1 – Recommended Practices for Welding Reinforcing Steel Metal Inserts, and Connections in Reinforced Concrete Construction.

I. AWS D1.4 – Structural Weld Code - Reinforcing Steel.

J. CRSI – Manual of Practice, and Documents 63 and 65.

1.04 SUBMITTALS

A. Submit shop drawings as follows:
   1. Notify Design Professional prior to detailing reinforcing steel shop drawings.
   2. Indicate size, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splice lengths, stirrup spacing, supporting and spacing devices. Detail reinforcing steel in accordance with ACI 315 and CRSI Standards.
   3. Written description of reinforcement without adequate sections, elevations, and details is not acceptable.
   4. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.

B. Submit a certification from each manufacturer or supplier stating that materials meet the requirements of the ASTM and ACI standards referenced.

C. Submit mill test reports.

D. Submit manufacturer's data for tensile and compressive splicers.

E. Submit manufacturer's data including installation recommendations for dowel adhesive.

1.05 QUALITY ASSURANCE

A. Coordinate and schedule in a timely manner with the Structural Testing/Inspection Agency the following quality related items:
   1. Verify reinforcing steel for quantity, size, location, and support.
   2. Verify proper reinforcing steel concrete coverage.

B. The Structural Testing / Inspection Agency shall provide special inspections as required by Chapter 17 of the building code as required by Specification Section 01 45 25.

1.06 STORAGE AND PROTECTION

A. Store reinforcing steel above ground so that it remains clean. Maintain steel surfaces free from materials and coatings which might impair bond.

PART 2 - **PRODUCTS**

2.01 MATERIALS

A. Deformed reinforcing steel shall conform to ASTM A615; refer to Structural Drawings for grade (Grade 60 minimum).

B. Welded steel wire fabric shall conform to ASTM A1064.

2.02 ACCESSORY MATERIAL

A. Annealed steel tie wire shall be 16-1/2 gage minimum.

B. Bar supports shall be plastic-tipped steel Class I bar supports conforming to CRSI Specifications. Concrete brick may be used to support reinforcement to obtain proper clearance from earth.

2.03 DOWEL ADHESIVE

A. Adhesive for reinforcing dowels in existing concrete shall conform to ASTM C881-02, Type IV, Grade 3, CLASS A, B, & C except gel times and epoxy content. Adhesive shall consist of a two component adhesive system contained in side by side packaging connected to a mixing nozzle which thoroughly mixes the components as it is injected into the hole. Adhesive shall have passed ICC Evaluation Services, Inc. Acceptance Criteria 308 for long term creep and be specifically approved for use in cracked concrete.

PART 3 - **EXECUTION**

3.01 FABRICATION

A. Fabricate steel in accordance with ACI 318 and CRSI standards.

B. Bend bars cold. Do not heat or flame cut bars. No field bending of bars partially embedded in concrete is permitted, unless specifically approved Design Professional and checked by Testing and Inspection Agency for cracks.

C. Weld only as indicated. Perform welding in accordance with AWS D12.1 and or AWS D1.4.

D. Tag reinforcing steel for easy identification.

3.02 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles and coatings.

B. Place, support, and secure reinforcement against displacement in accordance with ACI 318 and CRSI standards. Do not deviate from alignment or measurement.

C. Locate welded wire fabric in the top third of slabs. Overlap mesh one lap plus two inches at side and end joints.

D. Furnish and install dowels or mechanical splices at intersections of walls, columns and piers to permit continuous reinforcement or development lengths at such intersections.

E. Maintain cover and tolerances in accordance with ACI and CRSI Specifications, unless indicated otherwise on Structural Drawings.

3.03 SPLICES

A. Do not splice reinforcement except as indicated on Structural Drawings.

B. Tension couplers may be used and installed in accordance with manufacturer's specifications.

3.04 DOWELS IN EXISTING CONCRETE

A. Install dowels and dowel adhesive in accordance with manufacturer’s recommendations.

B. Minimum embedment length shall be 12 bar diameters, unless noted otherwise.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section includes cast-in-place concrete work indicated in the Contract Documents or otherwise required for proper completion of the work.

1.02 RELATED SECTIONS

A. Section 01 33 30 – Structural Submittals.

B. Section 01 45 25 – Structural Testing/Inspection Agency Services.

C. Section 03 10 00 – Concrete Formwork.

D. Section 03 20 00 – Concrete Reinforcement.

E. Section 03 62 00 – Non-Shrink Grout.

1.03 REFERENCES

A. ACI 214 – Recommended Practice for Evaluation of Strength Test Results of Concrete.

B. ACI 301 – Specifications for Structural Concrete for Buildings.

C. ACI 302.1 – Guide for Concrete Floor and Slab Construction.

D. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.

E. ACI 305 – Hot Weather Concreting.

F. ACI 306 – Cold Weather Concreting.

G. ACI 308 – Standard Practice for Curing Concrete.

H. ACI 309 – Guide for Consolidation of Concrete.

I. ACI 318 – Building Code Requirements for Structural Concrete.

J. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.

K. ASTM C33 – Standard Specification for Concrete Aggregates.

L. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

M. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

N. ASTM C138 – Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

O. ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete.

P. ASTM C150 – Standard Specification for Portland Cement.

Q. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

R. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

S. ASTM C230 – Standard Specification for Flow Table or Use in Tests of Hydraulic Cement.

T. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

U. ASTM C309 – Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

V. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

W. ASTM C618 – Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

X. ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.

Y. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

Z. ASTM E1155 – Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System.

1.04 NOTICE

A. Notify Design Professional and Structural Testing/Inspection Agency not less than 48 hours prior to placing concrete.

1.05 QUALITY ASSURANCE

A. Structural Testing/Inspection Agency shall perform the following quality related items:
   1. Examine concrete in truck to verify that concrete appears properly mixed.
   2. Perform a slump test for each concrete load. Record if water or admixtures are added to the concrete at the job site. Perform additional slump tests after job site adjustments.
   3. Mold four specimens per set for compressive strength testing; one set for each 75 cubic yards of each mix design placed in any one day. Perform one 7-day test for information and two 28-day compressive strength tests for acceptance. (Use one as a spare to be broken as directed by the Design Professional if compressive strengths do not appear adequate.) For each set molded, record:
      a. Slump.
      b. Air content.
      c. Unit weight.
      d. Temperature, ambient and concrete.
      e. Location of placement.
      f. Any pertinent information, such as addition of water, addition of admixtures, etc.
   4. Report in writing, as directed by the Design Professional, on the same day that tests are performed. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing agency, concrete design compressive strength, location of concrete placement in structure, concrete mix proportions and materials, compressive breaking strength and type of break.

B. The ready-mixed concrete plant shall be certified for conformance with the requirements of the National Ready Mix Concrete Association.

C. The Structural Testing / Inspection Agency shall provide special inspections as required by Chapter 17 of the building code as required in Specification Section 01 45 25.

1.06 ENVIRONMENT DEFINITION

A. Concrete elements considered to be in an aggressive environment include:
   1. Parking Slabs.
   2. Plazas.
   3. Exterior Balconies.

1.07 CONCRETE MIX DESIGN

A. Establish concrete mix design proportions in accordance with ACI 318, Chapter 5.

B. Submit concrete mix designs. Include the following:
   1. Type and quantities of materials.
   2. Slump.
   3. Air content.
   4. Fresh unit weight.
   5. Aggregates sieve analysis.
   6. Design compressive strength.
   7. Location of placement in structure.
   8. Method of placement.
   9. Method of curing.

10. Seven-day and 28-day compressive strengths.

C. Concrete supplier shall submit certifications that the materials used meet applicable ASTM Specifications. Mix designs not conforming to the above will be rejected.

1.08 SLUMP

A. Conventional concrete shall have a maximum slump of five inches.

B. If a slump greater than five inches is desired it shall be achieved with a high-range water reducer. All concrete containing the high range water reducing admixture shall have a maximum slump of 8 inches with a verified water slump of 2 to 3 inches.

1.09 FRESH UNIT WEIGHT

A. Normal weight concrete shall have a fresh unit weight of 140 to 152 pcf.

1.10 AIR CONTENT

A. Provide entrained air content per the table below and exposure category specified on structural drawings. Tolerance on air content as delivered shall be +/-1.5 percent. For f'c greater than 5,000 psi, reduction of air content indicated in the table below by 1.0 percent shall be permitted. No air content is required for Exposure Class F0.

Nominal maximum aggregate size, in.*	Air Content, percent	
	Exposure Class F1	Exposure Classes F2 and F3
3/8	6	7.5
1/2	5.5	7
3/4	5	6
1	4.5	6
1-1/2	4.5	5.5
* See ASTM C33 for tolerance on oversize for various nominal maximum size designations.		

1.11 WATER/CEMENTITIOUS MATERIAL RATIO

A. Provide a maximum water/cementitious material ratio in accordance with the structural general notes.

1.12 SUBMITTALS

A. Submit a concrete mix design as specified above for each type of concrete included in the work.

B. Submit a certification from each manufacturer or supplier stating that materials meet the requirements of the ASTM and ACI standards referenced.

C. Submit manufacturer's data including Product Data and installation instructions for the following items. Manufacturer's Data shall include the name of the manufacturer and date of the publication. All manufacturers' data shall be maintained at the project site by the contractor.
   1. Admixtures.
   2. Curing materials.
   3. Joint sealing materials.
   4. Expansion joint filler.
   5. Polymer repair compounds.
   6. Bonding agents.
   7. Underlayment and overlayment products.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials designated by specific manufacturer's trade names are approved, subject to compliance with the quality and performance indicated by the manufacturer. Instructions and specifications, published by the manufacturer of such materials are included in and are a part of these specifications. Upon request, provide certification from manufacturer or supplier that materials designated by reference to ASTM and ACI standards meet the requirements of these standards.

2.02 CONCRETE STRENGTH

A. Provide concrete strengths indicated on the Structural Drawings.

2.03 CEMENT

A. Portland cement shall conform to ASTM C150, Type I, unless noted otherwise. Use one brand only.

2.04 AGGREGATE

A. Fine aggregate shall conform to ASTM C33.

B. Coarse aggregate of gravel or crushed stone shall conform to ASTM C33, Class 3M. Size coarse aggregate in accordance with ACI 318.

2.05 WATER

A. Water shall be potable and free of deleterious substances in accordance with ACI 318.

2.06 AIR ENTRAINING AGENT

A. Air entraining agent shall conform to ASTM C260, certified by manufacturer to be compatible with other required admixtures.

2.07 WATER REDUCER

A. Water reducing agent shall conform to ASTM C494 Type A, and contain not more than 0.05 percent chloride ions.

2.08 WATER REDUCER AND RETARDER

A. Water reducing and retarding agent shall conform to ASTM C494, Type D, and contain not more than 0.05 percent chloride ions.

2.09 HIGH-RANGE WATER REDUCER

A. High-range water reducing agent (superplasticizer) shall conform to ASTM C494 Type F or Type G and contain not more than 0.05 percent chloride ions.

2.10 HIGH-RANGE WATER REDUCER AND RETARDER

A. High-range water reducing and retarding agent shall conform to ASTM C494 Type G and contain not more than 0.05 percent chloride ions.

2.11 NON-CHLORIDE, NON-CORROSIVE ACCELERATOR

A. Non-chloride, non-corrosive accelerating agent shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. <u>The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.</u>

2.12 ADMIXTURE CERTIFICATION

A. Written conformance with the specified requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Design Professional.

2.13 PROHIBITED ADMIXTURES

A. The use of calcium chloride thiocyanates or admixtures containing more than 0.05 percent chloride ions is prohibited.

2.14 SUPPLEMENTARY CEMENTITIOUS MATERIALS

A. Fly Ash: ASTM C618, Type F may be used up to a maximum of 25% of the total cementitious content.

B. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120 may be used up to a maximum of 40% of the total cementitious content.

C. The exact percentages of supplementary cementitious materials used shall be based on a successful test placement on-site.

2.15 RETARDERS

A. Retarders shall conform to ASTM C494.

2.16 CURING COMPOUND

A. Clear Curing and Sealing Compound (VOC Compliant, 350 g/l): Provide a liquid type membrane forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m^2 when applied at 300 ft^2/gal.

B. Curing Compound (Strippable, VOC Compliant, 350 g/l): Provide a compound conforming to ASTM C 309.

2.17 ELASTOMERIC JOINT SEALANT

A. Provide an elastomeric sealant conforming to ASTM C920, Type M, Grade P, Class 25.

PART 3 - EXECUTION

3.01 ADMIXTURE USAGE

A. Use admixtures according to manufacturer's written instructions.

B. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.

C. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

D. Use high range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, macro synthetic fiber concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

3.02 ADDITION OF WATER AT JOB SITE

A. Provide batch tickets indicating the amount of mix water withheld at the batch plant for each load of concrete delivered. Water may be added to the batch only if neither the maximum permissible water/cement ratio nor the maximum slump is exceeded.

B. Water shall not be added to the batch after the required on-site testing has been performed.

3.03 PLACEMENT OF CONCRETE

A. Deposit concrete as near as practical to final position to prevent segregation of concrete.

B. Do no flowing of concrete with vibrators.

C. Place floors and slabs in accordance with ACI 302.

D. Do not use aluminum equipment in placing and finishing concrete.

E. Prepare place of deposit, mix, convey, place, and cure concrete in accordance with ACI 301, ACI 304, and ACI 318. Wet forms or use approved form release agent before placing concrete.

3.04 TIME LIMIT

A. Deposit concrete within one and one-half hours after batching.

3.05 VIBRATION

A. Consolidate concrete in accordance with ACI 301 and ACI 309.

3.06 CURING

A. Begin curing procedures immediately following the commencement of the finishing operation.

B. Cure concrete in accordance with ACI 308. Keep the concrete surface moist and above 50o F for seven days. When high early strength concrete is used this time period may be reduced to 3 days.

C. Curing and Sealing Compound: All exposed troweled interior slabs, not receiving a penetrating liquid densifier, shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and architectural concrete, not receiving a penetrating sealer, shall be cured with the specified clear, non-yellowing curing and sealing compound. Maximum coverage shall be 400 ft^2/gallon on steel troweled surfaces and 300 ft^2/gallon on floated or broomed surfaces for the curing/sealing compound.

D. Use the specified strippable curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply in accordance with manufacturer's instructions.

3.07 ENVIRONMENTAL PROVISIONS

A. Perform cold weather concreting in accordance with ACI 306.1, Specification for Cold Weather Concreting, published by the American Concrete Institute.

B. Perform hot weather concreting in accordance with ACI 305.1, Specification for Hot Weather Concreting, published by the American Concrete Institute.

C. Protect concrete from drying and excessive temperature for the first seven days.

D. Protect fresh concrete from wind.

3.08 CONTRACTION JOINTS

A. Submit a plan for location of construction, contraction, and expansion joints for the Design Professional's approval.

B. Place contraction joints in slabs-on-grade with a maximum spacing of 24 times the slab thickness to form a regular grid. The long dimension of the grid shall not exceed 1.5 times the short dimension of the grid. Saw cut joints shall be cut as soon as possible after finishing without raveling but no later than 24 hours after placement of concrete. Saw cuts shall be a depth equal to one-fourth the slab thickness by one-eighth inch wide.

C. Provide contraction joints in concrete foundation or retaining walls at a maximum spacing of 20-foot but not more than 1.5 or less than 0.7 times the wall height. Space contraction joints equally between column interruptions in the wall surface such as pedestals, corners, or construction joints. Coordinate location with Architect. Contraction joints shall be formed as a V-groove on both faces of the wall, 3/4-inch minimum depth.

3.09 CUTTING CONCRETE

A. Obtain Design Professional's written approval prior to cutting concrete for installation of other work.

3.10 PATCHWORK AND REPAIRS

A. Notify Design Professional of any defective areas in concrete to be patched or repaired. Repair and patch defective areas with approved polymer repair mortars. Cut out defective areas over two inches in diameter to solid concrete, but not less than a depth of one inch. Make edges of cuts perpendicular to the concrete surface.

3.11 CONCRETE FINISHES

A. Finish concrete in accordance with ACI 301.

B. Finish concrete slabs to flatness and levelness tolerances which correspond to F_F 25/F_L 20 minimum overall for composite of all measured values and F_F 18/F_L 13 minimum for any individual floor section.

C. Slabs, which do not meet the flatness and levelness criteria shall be repaired or replaced.

END OF SECTION

SECTION 03 62 00
NON-SHRINK GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section includes non-shrink grout under base plates, bearing plates, and where specified in Contract Documents.

1.02 RELATED SECTIONS

A. Section 01 33 30 – Structural Submittals.

B. Section 01 45 25 – Structural Testing/Inspection Agency Services.

1.03 REFERENCES

A. CRD C621 – Specification for Non-Shrink Grout.

B. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

1.04 QUALITY ASSURANCE

A. Structural Testing/Inspection Agency shall perform the following quality related items:

1. Perform compressive strength tests in accordance with ASTM C109 with 2-inch x 2-inch cubes. Test one cube at three days, two cubes at seven days and three cubes at 28 days. Perform one test for each ten bags of grout used or one test in accordance with day of grouting.

1.05 SUBMITTALS

A. Submit product data sheets for review.

PART 2 - PRODUCTS

2.01 GROUT

A. Provide a non-shrink, non-metallic grout that complies with Corps of Engineers Specification CRD-C 621.

B. Grout shall have a minimum compressive strength of 5000 psi at 28 days.

2.02 WATER

A. Provide clean, potable water.

PART 3 - EXECUTION

3.01 HANDLING

A. Store and protect non-shrink grout from moisture and contamination.

3.02 PREPARATION

A. Remove mud, dirt and other foreign materials from areas to be grouted.

3.03 MIXING

A. Mix grout to its fluid, self-leveling consistency in accordance with manufacturer’s recommendations. Do not retemper grout. Do not exceed manufacturer's maximum limit on water content or use at a consistency which produces free bleeding. Mix grout in a paddle-type mortar mixer. Do not mix by hand.

3.04 PLACEMENT

A. Consolidate grout to provide uniformity. Do not vibrate grout.

B. Use forms to contain grout.

3.05 PROTECTION

A. Protect grout and areas to be grouted from excessive heat and cold in accordance with manufacturer's specifications. Protect grout from excessive drying shrinkage resulting from wind or direct sunlight. Protect areas grouted from excessive vibrations for three days.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Block.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 04 05 11 - Mortar and Masonry Grout.

C. Section 07 11 13 - Bituminous Dampproofing: Dampproofing parged masonry surfaces.

D. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.

E. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

I. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

J. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.

K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

L. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

N. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

P. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

Q. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

S. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.
   1. Coordinate to coincide with regularly scheduled jobsite meeting and schedule only after all related shop drawings and submittals have been approved.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

B. Fire Rated Assemblies: Conform to applicable code for _____ requirements for fire rated masonry construction.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 12 inches (300 mm).
   2. Special Shapes: Provide non-standard blocks configured for corners and end conditions.
   3. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Normal weight.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
   1. Hohmann & Barnard, Inc (including Dur-O-Wal brand); _____: www.h-b.com. Basis of Design. X-Seal.
   2. WIRE-BOND: www.wirebond.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reinforcing Steel: Type specified in Section 03 20 00; size as indicated on drawings; galvanized finish.

C. Single Wythe Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.

2.04 ACCESSORIES

A. Preformed Control Joints: Polyvinyl chloride material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Blok-Lok Limited; _____: www.blok-lok.com/#sle.
      b. Hohmann & Barnard, Inc (including Dur-O-Wal brand); _____: www.h-b.com/#sle.
      c. WIRE-BOND: www.wirebond.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.
   3. Exterior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave typical; flush below grade..

3.05 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.

3.07 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 8 inches (200 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Install reinforcement to coincide and connect with existing reinforcement where tying into existing masonry.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.09 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.10 CUTTING AND FITTING

A. Cut and fit for chases and vents. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.12 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud interior wall framing for support of padding.

B. Interior wall sheathing, as backer for wall padding.

1.02 RELATED REQUIREMENTS

A. Section 13 34 19 -

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

F. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.

H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

J. PS 1 - Structural Plywood; 2009.

K. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations .

C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Shop Drawings: Indicate component details, anchorage, loading, type and location of fasteners, and wall framing, and accessories or items required of related work.
   1. Describe method for securing studs to tracks and for bolted framing connections.

E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
   1. Clarkwestern Dietrich Building Systems LLC; ____: www.clarkdietrich.com.
   2. Marino; ____: www.marinoware.com/#sle.
   3. The Steel Network, Inc; _____: www.SteelNetwork.com/#sle.
   4. Unimast. www.unimast.com
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Framing Connectors and Accessories:
   1. Same manufacturer as metal framing.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Criteria: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
   2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   3. Design Loads: Interior studs to be designed for 5 PSF plus 200 lbs. at 5'-0" high. Exterior walls should reference structural documents for wind loads.
   4. Live load deflection meeting the following, unless otherwise indicated:
      a. Exterior Walls: Maximum horizontal deflection under wind load of L/720 of span. Comply with Brick Institute of America criteria for brick veneer application.
      b. Design non-axial loadbearing framing to accommodate not less than 1/2 in (13 mm) vertical deflection.
   5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and depth: Depth as indicated on the drawings. Gage as required to meet specified performance levels.
   2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

B. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

2.05 WALL SHEATHING

A. Plywood; PS 1, Grade C-C, Exterior Exposure. Fire-treated.

2.06 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

D. Water-Resistive Barrier: As specified in 07 27 28.

2.07 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 16 inches (____ mm) on center. Fastener spacing and sizing by structural engineer noted in Division One.

C. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using per structural engineer method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

H. Install intermediate studs above and below openings to align with wall stud spacing.

I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

J. Attach cross studs to studs for attachment of fixtures anchored to walls.

K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.03 WALL SHEATHING

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
   1. Fasten boards and tape joints per manufacturer's printed instructions or UL listing.
   2. Stagger sheets and terminate all vertical joints on studs.
   3. Install butt joints with a maximum gap of 1/16".

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch (____ mm).

B. Maximum Variation of any Member from Plane: 1/8 inch (____ mm).

END OF SECTION

SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

1.02 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.

B. ASTM D43/D43M - Standard Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing; 2000 (Reapproved 2012).

C. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 2003 (Reapproved 2014).

D. ASTM D450/D450M - Standard Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing; 2007 (Reapproved 2013).

E. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.

F. ASTM D3747 - Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation; 1979 (Reapproved 2007).

G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007, with Editorial Revision (2012).

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

I. ASTM D5643/D5643M - Standard Specification for Coal Tar Roof Cement, Asbestos Free; 2006 (Reapproved 2012).

J. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Bituminous Dampproofing Manufacturers:
   1. Karnak Corporation; _____: www.karnakcorp.com/#sle.
   2. Mar-Flex Systems, Inc; _____: www.mar-flex.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.

1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
3. VOC Content: Not more than permitted by local, State, and federal regulations.
4. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.
5. Products:
   a. W. R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com/#sle.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. _____: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Seal items watertight with mastic, that project through dampproofing surface.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at exterior wall behind _____ wall finish and CMU wall..

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

1.03 REFERENCE STANDARDS

A. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block; 2008 (Reapproved 2012).

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

I. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 24 x 96 inch (610 x 2440 mm).
   4. Board Thickness: 2 inches (50 mm).
   5. Board Edges: Tongue-and-groove.
   6. Thermal Resistance: R-value of 4.6 per 1 inch (25.4 mm) at 75 degrees F (24 degrees C) mean temperature.

7. Compressive Resistance: 25 psi (173 kPa).
8. Board Density: 1.20 lb/cu ft (19 kg/cu m).
9. Water Absorption, Maximum: 0.3 percent, by volume.
10. Manufacturers:
    a. Dow Chemical Co: www.dow.com.
    b. Owens Corning Corp: www.owenscorning.com.
11. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cellular Glass Board Insulation: Cellular glass board, ASTM C552, Type IV, with the following characteristics:
1. Flame Spread Index: 5 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0, when tested in accordance with ASTM E84.
3. Board Size: 24x48 inch (____x____ mm).
4. Board Thickness: 4 inch (____ mm).
5. Board Edges: Square.
6. Apparent Thermal Conductivity; K (Ksi) value at 0 degrees F (-18 degrees C): 0.27 (0.038).
7. Water Absorption: In accordance with ASTM C240, 0.5 percent by volume maximum.
8. Facing: Factory applied skin of aluminum foil on one face.
9. Manufacturer: _____.
10. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Adhesive: Type recommended by insulation manufacturer for application. Confirm compatibility with Fluid Applied Vapor Permeable Membrane Air Barriers specified in 07 27 28.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Apply adhesive to back of boards:
1. Three continuous beads per board length.
2. Full bed 1/8 inch (3 mm) thick.

B. Install boards horizontally on walls.
1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Extend boards over expansion joints, unbonded to wall on one side of joint.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 90 05
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

A. Section 13 34 19 - Metal Building Systems

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

D. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

F. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit two samples, 6x6 inch (____x____ mm) in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide products having volatile organic compound (VOC) content as specified in Section 01 61 16.

B. Silicone Sealant: ASTM C920, Grade NS, Class 25 minimum; Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -65 to 180 degrees F (-54 to 82 degrees C).

4. Shore A Hardness Range: 15 to 35.
5. Applications: Use for:
   a. Juncture of exterior wall and curb at concrete stem wall.
6. Products:
   a. Dow Corning Corporation; 795 Medium Modulus: www.dowcorning.com/#sle.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2:1.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants from dust and debris to prevent staining until cured.

END OF SECTION

SECTION 09 90 01
PAINTING & COATINGS

PART 1 – GENERAL

1.01 SUMMARY OF WORK

A. Project Overview
   1. The Work in this Section requires the surface preparation and field application of primers, paints, stains and coatings to surfaces appearing in this Schedule.

1.02 RELATED SECTIONS:

A. Section 13 34 19 - Metal Building Systems

1.03 REFERENCES

A. Occupational Safety & Health Act (OSHA) Safety Standards

B. American National Standards Institute (ANSI) Performance Standards

C. National Paint and Coatings Association (NPCA) Gloss Standard

D. American Society for Testing Materials (ASTM) Testing Methods

E. Master Paint Institute (MPI) established paint categories and standards

F. Ozone Transmission Commission (OTC) established levels of Volatile Organic Compounds.

1.04 DEFINITIONS

A. Commercial as used in this Section refers to a painter grade product.

B. DFT as used in this Section refers to the Dry Film Thickness of the coating.

C. DTM as used in this Section refers to a product that can be applied Direct To Metal.

D. Enamel refers to any acrylic or alkyd (oil) base paint which dries leaving an eggshell, pearl, satin, semi-gloss or high gloss enamel finish.

E. Gloss levels as established by the National Paint & Coating Association (NPCA) using ASTM test method
   1. #D-523 are as follows:

a.	Flat	0 – 5	60 degree meter
b.	Eggshell	5 - 20	60 degree meter
c.	Satin	20 - 35	60 degree meter
d.	Semi-Gloss	30 – 65	60 degree meter
e.	Gloss	over - 65	60 degree meter

F. Premium as used in this Section refers to the best quality “top of the line” products.

G. VOC as used in this Section refers to Volatile Organic Compounds found in primers, paints, sealers and stains.
   1. The level of VOCs appears after each product listed in the Interior Schedule in grams per liter (g/L).

1.05 SUBMITTALS

A. Submit a product data sheets and material safety data sheets for all primers, paints, stains and coatings used.

B. Submit 8-1/2” X 11” draw downs of each color in the products and sheen to be used for approval by the Owner/Architect.

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Work is to be done by qualified painters with a minimum of three years experience in surface preparation and paint application.

B. Field Samples
   1. Apply a sample of the coating system in an area designated by the Owner/Architect.

C. Manufacturer's Warranty
   1. Inspection of all surfaces to be coated must be done by the manufacturer's representative to insure proper preparation prior to application.
   2. All thinners, fillers, primers and finish coatings must be from the same manufacturer to support a product warranty. Products other than those submitted must be accompanied by a letter stating its fitness for use and compatibility.

1.07 DELIVERY AND HANDLING

A. Product
   1. Primers, sealers, stains and coatings must be delivered to the site in original, containers with manufacturers label intact.
   2. Labels must remain on all containers used to hold primers, paints or stains while on site. Containers without labels are to be disposed of.
   3. Product name, number, health and safety information, and precautions must be legible at all times during storage and use.

B. Storage
   1. Coatings material and thinners stored on site must be kept in a clean, secure and climate controlled area designated by the Owner.

C. Waste Management & Disposal
   1. Disposal containers for recycled materials must be established on site.
   2. Dispose of rags containing solvent, daily.
   3. Dispose of hazardous coatings in accordance with state, county and local regulations for hazardous waste disposal.

1.08 SITE CONDITIONS

A. Site Inspection:
   1. The Contractor will inspect surfaces to be painted for signs or defects, physical damage, excessive moisture or contamination that would prevent proper adhesion. Notify the Architect and Owner of any damages or conditions.
   2. The Contractor will test existing coatings for lead prior to bid submittal.

1.09 SCHEDULING

A. The Contractor will schedule the work in a manner to avoid delay or contamination to prepared surfaces or surfaces already completed.

PART 2 – PRODUCT

2.01 MANUFACTURER'S

A. Approved Manufacturers:
   1. Benjamin Moore & Company (Basis of Design)
   2. Coronado Paints and Coatings
   3. Sherwin Williams & Company.
   4. Pittsburgh Paints.

2.02 PRECAUTIONS

A. The Contractor is to review the product manufacturers special instructions for surface preparation, application, temperature, re-coat times, and product limitations.

B. The Contractor is to review product health and safety precautions listed by the manufacturer.

C. The Contractor is responsible for enforcing on site health and safety requirements associated with the Work.

2.03 INTERIOR PAINT SCHEDULE

A. Masonry (Existing or New)
   1. Premium Waterbase System: (one filler coat and two finish coats)
      a. Filler:
         1) 206 Super Spec Acrylic Latex Block Filler (45 g/L)

b. Finish:
1) 551 Regal Select Acrylic Semi-Gloss Enamel (38 g/L)

B. Ferrous Metal – Steel, Iron - Doors, Frames, Handrails, existing Metal building components including structure, metal panels, and accessories.
1. Premium Waterbase System: (shop primed with two finish coats)
a. Finish:
1) 793 Advance Waterborne Alkyd Semi-Gloss Enamel(48 g/L; LEED compliant

C. Non Ferrous - Galvanized Metal
1. 1. Premium Waterbase System: (one prime coat and two finish coats)
a. Primer:
1) P04 Super Spec HP Acrylic Metal Primer (54 g/L)
b. Finish:
1) 551 Regal Select Acrylic Semi-Gloss Enamel (38 g/L)

D. Wood: Plywood (Painted)
1. Premium Waterbase System: (one prime coat and two finish coats)
a. Primer:
1) 023 Fresh Start 100% Acrylic Primer Sealer (50 g/L)
b. Finish:
1) 551 Regal Select Acrylic Semi-Gloss Enamel (38 g/L)

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Surface condition:
1. The Contractor shall inform the owner of any surfaces that are not suitable for application.
2. The Contractor is responsible for protecting sidewalls, shrubbery, cars, fences or adjacent surfaces not to receive paint.
3. Additional cost in time and money to replace or repair surfaces not adequately protected will be paid by the Contractor.
4. Upon completion, the condition of the unpainted surfaces shall be as originally found prior to the Work.
5. Do not tint primers the same color as the finish coat.

B. CMU - Concrete Block
1. Remove dirt and dust from horizontal mortar rows down to a clean dry surface.
2. Repair holes, cracks and loose mortar before application of the block filler and paint.
3. Do not apply block filler to a wet surface. Allow to completely dry before application.
4. Apply materials at the temperature recommended by the manufacturer.

C. Ferrous Metal: (Steel, Iron)
1. Remove all mildew, dirt, dust, loose rust or other contaminates that would prevent proper adhesion to the surface.
2. Remove all peeling paint and marginally loose paint down to a sound surface.
3. Sand rusty or bare metal surfaces and apply rust inhibitive metal primer.
4. Repair or replace damaged metal surfaces before priming or painting..
5. Remove old brittle or cracked caulking and re-caulk to properly seal windows and doors.

D. Non-Ferrous Metal: (Galvanized)
1. Remove all mildew, dirt, dust, white rust or other contaminates that would prevent proper adhesion to the surface.
2. Remove all peeling or marginally loose paint down to a sound surface.
3. Sand edges to remove cratering and clean sanding dust from the surface.
4. Make repairs or replace damaged metal before priming or painting.
5. Remove old brittle or cracked caulking and re-caulk to properly seal windows, doors and trim.

E. Wood (Painted)

1. Remove all mildew, dirt, loose dust or other contaminates that would prevent proper adhesion to the surface.
2. Remove mill marks and wood grade stamp completely.
3. Repair or replace damaged wood surfaces.
4. Prime all bare wood surfaces before application of the finish coat.
5. Remove old brittle or cracked caulking and re-caulk to properly seal windows, doors and trim.

3.02 APPLICATION

A. Application of any primers, paints, stains or coatings will serve as acceptance by the contractor that surfaces were properly prepared in accordance to manufacturers label directions and written specifications.

B. Apply paint only when surface and air temperature meet the manufacturer's recommendations.

C. Apply evenly and spread smoothly with manufacturers recommended type of brush, roller or spray equipment.

D. Apply the number of coats specified to achieve the recommended dry film thickness and coverage.

E. Apply material within the recoat time recommended by the manufacturer for each product used.

F. Allow each coat to dry before application of additional coats.

G. Paint all exposed mechanical and electrical components components exposed to view including surfaces inside ductwork.

3.03 3.03 COLOR

A. Refer to the Finish Schedule in the Drawings for color location.

B. Colors shall leave a uniform sheen and appearance

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Product Data: Provide extinguisher operational features.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc; _____: www.jlindustries.com.
   2. Larsen's Manufacturing Co; _____: www.larsensmfg.com/#sle.
   3. Potter-Roemer; _____: www.potterroemer.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Class: A:B:C.
   2. Size: 10 pound (4.54 kg).
   3. Finish: Baked polyester powder coat, color as selected.
   4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to ___ degrees F (___ degrees C).

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place extinguishers on wall brackets.

END OF SECTION

SECTION 11 66 23
GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted protection pads.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold Formed Framing.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
   1. Manufacturer's installation instructions.

C. Shop Drawings: For custom fabricated equipment indicate, in large scale detail, construction methods; method of attachment or installation; type and gage of metal, hardware, and fittings; plan front elevation; elevations and dimensions; minimum one cross section; utility requirements as to types, sizes, and locations.

D. Samples: Submit samples of wall pad coverings in manufacturer's available range of colors.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.

B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.

C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 GENERAL REQUIREMENTS

A. See drawings for sizes and locations, unless noted otherwise.

B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of contract documents.

C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

2.03 WALL PADDING

A. Wall Padding: Foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece.
   1. Covering: Vinyl-coated polyester fabric, mildew and rot resistant; stapled to back of board.
      a. Color: As selected from manufacturer's standard range.
      b. Texture: Embossed leather-look.
      c. Fabric Weight: 14 oz/sq yd (0.52 kg/sq m).
      d. Fire Retardancy: Class A (ASTM E-84)
      e. Treatment: BACshield Anit-Mildew, UV, CPSIA/Low Lead
   2. Foam: Urethane, soft, 3.5 pcf (55 kg/cu m) nominal density.
   3. Foam: Open cell polychloroprene (Neoprene) 5.5 pcf (90 kg/cu m) nominal density.
   4. Foam Thickness: 2 inches (50 mm).
   5. Backing Board: Plywood.
      a. Thickness: 7/16 inch (__ mm).
      b. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84.
   6. Panel Dimensons: As indicated on drawings.
      a. Bottom of panel to slope to be parallel with court surface (1%); Maximum 2" between the court surface and bottom of the pad.
   7. Mounting: Removable; Z-clips fixed to wall and to padding.
   8. Manufacturers:
      a. Promats; www.promatsathletics.com
      b. Draper, Inc; EcoVision Wall Pad: www.draperinc.com/#sle.
      c. IPI by Bison, Inc; Indoor Solid Color Vinyl Padding: www.ipibybison.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

3.02 INSTALLATION

A. Install in accordance with contract documents and manufacturer's instructions.

B. Install equipment rigid, straight, plumb, and level.

C. Secure equipment with manufacturer's recommended anchoring devices.

D. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

E. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

A. Verify proper placement of equipment.

B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.

3.04 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11 68 33

ATHLETIC EQUIPMENT - CABLE SUPPORTED WALK DRAW GYM DIVIDER CURTAIN

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.02 SUMMARY

A. This Section includes the following:
   1. Cable Supported Walk Draw Gym Divider Curtain

B. Related Sections include the following:
   1. Section 13 34 19 - Metal Building Systems

1.03 REFERENCES STANDARDS

A. American Society for Testing and Materials:
   1. ASTM D471 “Standard Test Method for Rubber Property”
   2. ASTM D1239 “Standard Test Method for Resistance of Plastic Films to Extraction by Chemicals”
   3. ASTM-D-750 “Standard Test Method for Rubber Deterioration Using Artificial Weathering Apparatus”

1.04 SYSTEM DESCRIPTION

A. The manufacturer shall supply a cable supported walk draw gym divider curtain complete with all hardware and accessories necessary for a complete and aesthetically balanced installation.

1.05 SUBMITTALS

A. Product Data: For each product indicated, include manufacturer’s product literature, shop drawings, and product performance data indicating compliance with this specification.

B. Installation Drawings: Show layout, locations, components, materials, dimensions, sizes, and weights, finishes of components, installation and operational clearances, and details of attachment/bracing.

C. Samples: Submit color selections and samples for finishes from manufacturer’s full line on the vinyl coated polyester, #36 GA netting and mesh fabric to the Architect for approval.

1.06 QUALITY ASSURANCE

A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and the materials and techniques specified. Review and follow manufacturer’s installation instructions.

B. Provide cable supported walk draw gym divider curtain, as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of 10 years documented experience.

D. Contractor shall be responsible for all field measurements prior to ordering cable supported walk draw gym divider curtain.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver cable supported walk draw gym divider curtain and accessories to project site, completely pre-finished. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping. Materials shall be handled and stored properly to protect against damage and theft.

B. Handle cable supported walk draw gym divider curtain components to protect finish coating from any scuffs, abrasion or other damage during unloading and installation. Excessive damage to factory applied coatings will be cause for rejection.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: M. Putterman & Co., LLC (DBA Putterman Athletics). www.puttermanathletics.com

B. Other Suitable Manufacturers:
   1. Douglas Sports Equipment; www.douglas-sports.com
   2. Porter Athletic; www.porterathletic.com
   3. Substitutions - Refer to Section 01 60 00.

2.02 MATERIAL

A. Cable supported walk draw gym divider curtain: Subject to the performance and design requirement specified herein, curtain shall be manufactured from the following materials:
   1. Initial 15ft of curtain panels shall be solid vinyl, polyester reinforced vinyl coated fabric 19 ounce per square yard, containing antibacterial, fungi-resistant and flame-retardant chemicals to meet requirements of ASTM E-84 Class A Rating - 25 Flame Spread, 450 Smoke Development, and NFPA-701 large scale, ULC S-109 large and small scale, and State of California test requirements.
   2. Colors available: Red, Royal Blue, Green, Gray, Black, Yellow, Tan, Orange, White and Navy Blue. Bottom of Curtain to contain a concealed chain weight and shall be secured at each end of curtain panel.
   3. Remaining section shall consist of a 2ft lower mesh bottom with #36 GA netting above. Mesh to be designed with an approximate 65% open area for air breathing or air transfer. Mesh material shall be a 17x11, 1000 denier polyester base fabric with a flexible PVC coating and a finished weight of 14 ounce per square yard. Meets Federal Standard 191, Method 5903-.2, vertical fire-retardancy requirements. Colors available: White, Royal Blue, Forest Green , Yellow, Black and Red. #36 GA netting above to be 100% knotted nylon with a break strength of 365 lbs/strand. Netting will yellow at temperatures exceeding 300F and melt at 482F. Colors available are green, black and white. Top hem of curtain shall be 2 -3/4 inches wide, solid material, with 3/8 inch ID grommets spaced 12 inches o.c.
   4. Construction of curtain panels shall be a combination of heat sealed and double needle lock-stitched seams. Curtain panels will be supplied with ½ inch of fullness per foot of room size to allow curtain to fully extend from wall to wall without stretching.
   5. Curtain panels to be supported by means of a ¼” dia. 7x19 strand galvanized steel cable with a break strength of 7200 lbs. Each end of cable to receive a ½” dia. X 9” steel galvanized jaw to jaw turnbuckle for proper tensioning. ½” dia. Forged eyebolts are provided and secured to structural steel members of building for a safe and secure support. 9mm snap clips are attached to curtain secure to cable to join the curtain to the cable support.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify all areas to receive cable supported walk draw gym divider curtain.

B. Coordinate cable supported walk draw gym divider curtain installation with work of other sections.

C. Examine existing conditions under which the cable supported walk draw gym divider curtain is to be installed. Notify Contractor of unsatisfactory conditions. Do not proceed with work until conditions are satisfactory to the installer.

3.02 INSTALLATION

A. Install cable supported walk draw gym divider curtain in accordance with manufacturer's instructions and approved installation drawings.

B. Handle walk draw gym divider curtain components to protect finish coating from any scuffs, abrasions, tears, or other damage during installation. Excessive damage to factory applied coatings will be cause for rejection.

C. Avoid unnecessary cutting, drilling, and welding of pre-finished components. If necessary to cut drill, weld, or otherwise modify product due to field conditions, repair factory finish in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.

B. Metal wall and roof panels including gutters and downspouts, roof mounted equipment curbs, and vinyl coated insulation.

C. Exterior doors and overhead doors.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast in Place Concrete.

B. Section 07 92 00 - Joint Sealants: Sealing joints between accessory components and wall system.

C. Section 09 90 00 - Paints and Coatings

D. SEction 23 37 14 - Louvers

1.03 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2010.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

G. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2014.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).

J. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2010.

K. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

P. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2012.

Q. MBMA (MBSM) - Metal Building Systems Manual; 2012.

R. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

S. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Engineering: Submit complete structural analysis and design calculations.

C. Product Data: Provide data on profiles, component dimensions, fasteners.

D. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

E. Samples: Submit two samples of precoated metal panels for each color selected, _16__by___24_ inch (____by____ mm) in size illustrating color and texture of finish.

F. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.

G. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

H. Designer's Qualification Statement.

I. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
   1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.

J. Erector's Qualification Statement.

K. Project Record Documents: Record actual locations of concealed components and utilities.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
   2. Conform to applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency, or authorities having jurisdiction, and provide data as requested.

B. Perform work in accordance with AISC 360, MBMA (MBSM), and _____.
   1. Maintain one copy on site.

C. Perform welding in accordance with AWS D1.1/D1.1M.

D. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than five years of documented experience
   2. Accredited by IAS in accordance with IAS AC472.

E. Erector Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide twenty year manufacturer warranty for finish and performance.
   1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers
   1. Butler Manufacturing Company; ____: www.butlermfg.com/#sle.
   2. Ceco Building Systems; ____: www.cecobuildings.com/#sle.
   3. Metallic Building Company; _____: www.metallic.com/#sle.
   4. Nucor Building Systems; _____: www.nucorbuildingsystems.com/#sle.
   5. VP Buildings; ____: www.vp.com/#sle.
   6. Tifton Building Systems: www.tiftonbuildingsystems.com
   7. DCI Metal Buildings: www.dcimetal builidings.com
   8. L&G Metal Building Consultants: lgbuildingsandconcrete.com
   9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ASSEMBLIES

A. Single span rigid frame with supermarket bent. Clear height at eave and ridge as indicated on drawings.

B. Bay Spacing: As indicated on drawings.

C. Primary Framing: Rigid frame of rafter beams and columns, canopy beams and end wall columns, and wind bracing.

D. Secondary Framing: Purlins, and other items detailed.

E. Wall System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, and accessory components.

F. Roof System: Preformed metal panels oriented parallel to eave, with sub-girt framing/anchorage assembly, insulation, and liner panels, and accessory components.

G. Roof Slope: 3 inches in 12 inches (_____).

2.03 PERFORMANCE REQUIREMENTS

A. Installed Thermal Resistance of Wall System: R-value of 18.41 (RSI-value of ____).

B. Installed Thermal Resistance of Roof System: R-value of 18.41 (RSI-value of ____).

C. Refer to Structural drawings for loading and drift criteria.

D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

E. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of ____ degrees F (____ degrees C).

F. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.04 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A36/A36M.

B. Structural Tubing: ASTM A500/A500M, Grade B cold-formed.

C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.

D. Anchor Bolts: ASTM A307, Grade A, with no preference for protective coatings.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.

F. Welding Materials: Type required for materials being welded.

G. Primer: SSPC-Paint 20, zinc rich.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).
   3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
      a. Maximum: Plus 4 percent.
      b. Minimum: Plus 1 percent.

2.05 MATERIALS - WALLS AND ROOF

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Designation SS (structural steel), Grade 33 (230), with G90/Z275 coating.

B. Insulation: Roll glass fiber type, faced with reinforced white vinyl, ASTM E84, Class A, flame spread index of 25 or less where exposed, friction fit, 8 inches (____ mm) thick.
   1. Insulation facing: Specialty facing, heavy duty, abuse resistant film/fabric, designed for athletic facilities. Basis of design: Lamtec Gymguard www.lamtec.com
      a. Composition: 0.0015" white metallized polypropylene film laminated to a fiberglass & polyester blend fabric with a fire reistant adhesive.
      b. Performance:
         1) Water Vapor Permeance: 0.02 perm (1.15 ng/N · s) per ASTM E 96, Procedure A.
         2) Mullen Burst: 250 psi (17.6 kg/cm²).
         3) Tensile Strength: 195 lbs/inch (34.1 kN/m) in the machine direction and 150 lbs/inch (26.3 kN/m) in the cross-machine direction.
      c. Compliance: ASTM C 1136; ASTM C 991; ASTM E 84; ASTM E 96; ASTM C 1258; ASTM C 1338; Factory Mutual (FM) 4880; and UL 723.

C. Joint Seal Gaskets: Manufacturer's standard type.

D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.

E. Bituminous Paint: Asphaltic type.

F. Sealant: Manufacturer's standard type except as noted otherwise in section 09 72 00.

G. Roof Curbs: Insulated metal same as roofing, ____ inch (____ mm) thick, designed for imposed equipment loads, anchor fasteners to equipment, counterflashed to metal roof system.

H. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Rain Water Diverter, Fascias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.06 ACCESSORY COMPONENTS

A. Doors and Frames: Manufacturer's standard.

B. Overhead Doors and Frames: Manufacturer's standard.

C. Wall Louvers as specified in section 23 37 14.

2.07 DESIGN CRITERIA

2.08 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.

C. Provide framing for wall and roof openings. Coordinate with mechanical.

D. Provide miscellaneous framing to support the following:
   1. Scoreboards
   2. Wall padding
   3. Unit heaters
   4. Ceiling fans
   5. Lighting
   6. Divider net terminations
   7. Electrical panels

2.09 FABRICATION - WALL AND ROOF PANELS

A. Siding: Minimum 24 gage; profile as indicated on drawings, lapped edges fitted with continuous gaskets; panels continuous from sill to eave.
   1. 16" wide with 4" wide fluted profile.
   2. Emboseed textured finish.
   3. Concealed fasteners.
   4. Field located thermal blocks.
   5. Finish: Kynar 400 applied to G90 galvanized or Galvalue steel.

B. Roofing; Minimum 24 gage Architectural Standing Seam; factory applied sealant, field seamed at side lap joint.
   1. 16' wide net coverage.
   2. 2" high standing seam profile.
   3. Concealed clips designed to accommodate thermal expansion and contraction.
   4. Finsh: Kynar over Galvalume steel

C. Girts/Purlins: Rolled formed structural shape to receive siding, roofing sheet.

D. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners with ____ inch (____ mm) thick sheet.

E. Expansion Joints: Same material and finish as adjacent material where exposed, ____ inch (____ mm) thick, manufacturer's standard brake formed type, of profile to suit system.

F. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.

G. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.10 FABRICATION - GUTTERS AND DOWNSPOUTS

A. Fabricate of same material and finish as roofing metal.

B. Form gutters and downspouts of rectangular profile and size indicated to collect and remove water. Fabricate with connection pieces.

C. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.

D. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.11 FINISHES

A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.

B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, _____ color as selected from manufacturer's standard range.

C. Interior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, _____ color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.

E. Provide expansion joints where indicated.

F. Use concealed fasteners.

G. Install insulation utilizing secondary framing for attachment.

H. Install sealant and gaskets, providing weather tight installation.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Slope gutters minimum 1/4 inch/ft (____ mm/m).

C. Connect downspouts to storm as indicated on Civil drawings. Utilize downspout boots as specified.

3.05 INSTALLATION - ACCESSORY COMPONENTS IN WALL SYSTEM

A. Install door frames, doors, and overhead doors in accordance with manufacturer's instructions.

3.06 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

B. Siding and Roofing: 1/8 inch (3 mm) from true position.

END OF SECTION

SECTION 21 00 00
FIRE SUPPRESSION

PART 1: GENERAL

1.1 DESCRIPTION

A. This Section specifies requirements for the sprinkler system and fire service piping to the building.

1.2 RELATED SECTIONS

A. Section 21 00 10 General Provisions – Fire Suppression

B. Section 21 01 00 Operation and Maintenance of Fire Suppression

C. Section 21 05 00 Common Work Results for Fire Suppression

D. Section 21 05 53 Identification for Fire Suppression Piping and Equipment

E. Section 21 10 00 Pipe, Fittings and Accessories – Fire Suppression

1.3 SUBMITTALS

A. See General Conditions for submittal procedure.

B. All submittals of catalog materials shall be complete and bound in a folder with the job name and the name of the installing contractor on the cover. Piecemeal and incomplete submittals are not acceptable.

C. Catalog material shall be clearly and neatly marked to show applicable model numbers and options. Any deviations or substitutions from specified material requirements shall be specifically identified in a summary sheet at the front of the submittal. Materials not relevant to the job shall be deleted or clearly marked. Piping submittals shall indicate the material qualities and wall thickness schedules to be used.

D. Submit catalog data on the following:

1. Alarm valves and trim
2. Piping and fittings - above ground and underground
3. Pipe hangers
4. Couplings
5. Sprinklers
6. Valves
7. Valve boxes
8. Valve cabinets
9. In-Building riser
10. Waterflow switches
11. Valve monitor switches

E. Submit sprinkler working plans drawn to a minimum scale of 1/8" = 1'0". Drawings and calculations shall meet the requirements outlined in NFPA 13 Chapter 23 *Plans and Calculations* and include the following information:

1. Type, temperature ratings, and locations of all sprinklers
2. Location of mechanical equipment with defined service access areas.

3. The location and size of the remote area of coverage including number of sprinklers calculated, hazard classification, flow and pressure requirements as determined by hydraulic calculations.
4. Show pipe lengths, hanger locations, and pipe distances from column centerlines, in addition to all data required by NFPA 13.

F. Submit complete hydraulic calculations for all piping. Hydraulically calculated pipe sizes shall be shown.

G. Working plans shall be approved and stamped by the insurer's agent prior to submission to the Architect.

H. Reflected ceiling plans shall be included indicating coordination of all sprinklers with lighting, diffusers, and ceiling types.

I. Submit a letter with the catalog data and working plan submittals certifying that welders and welding procedures meet the requirements of AWS D10.9.

J. After installation, inspection, and tests are complete, submit to the Architect. Material and Test Certificates as required by NFPA 13 with all data typed in and bearing the required signatures. A copy of these approved certificates shall be turned over to the Owner with other maintenance data.

K. Provide manufacturer’s instructions, indicate installation and support requirements.

L. Provide operation and maintenance procedures; include start-up instructions, assembly drawings and parts list.

M. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable manufacturer's style or series number.

N. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.4 QUALITY ASSURANCE

A. All work shall be in strict accordance with Floyd County requirements, and the following, including the latest Georgia State Fire Commissioner’s Rules and Regulations:

1. NFPA 13 – 2013 Edition, Standard for the Installation of Sprinkler Systems.
2. NFPA 24 - 2013 Edition, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
3. NFPA 25 - 2011 Edition, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
4. Chapter 120-3-3 *Rules and Regulations for the State Minimum Fire Safety Standards*

B. The system shall be installed by an experienced firm regularly engaged in the installation of sprinkler systems. The installing firm shall have a current Certificate of Competency from the Georgia State Fire Marshal's office.

C. All work shall be in accordance with owner’s insurance underwriter requirements and shall be reviewed by said agency prior to being submitted to the Architect.

D. All shop drawings to be submitted to the local and/or state authority for review prior to submittal to the Architect.

E. All products and components installed in the system shall be Factory Mutual approved and listed by Underwriters Laboratories.

F. All welders and procedures shall be qualified according to the American Welding Society Standard AWS D10.9 Level AR-3 and a written record of this qualification shall be submitted.

G. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.

1.5 SPRINKLERED AREA

A. All portions of the building shall be sprinkled, unless specifically noted herein not to be sprinklered.

B. Areas subject to freezing (such as vestibules, canopies, or overhangs) shall be protected with dry pendent/sidewall sprinklers extended from the wet sprinkler system, unless other systems are specifically noted. Where dry type sprinklers cannot be installed, design shall include an auxiliary dry pipe system with control valve, strap on air compressor and dry pipe sprinklers.

C. All electrical closets shall be sprinkled unless specifically noted otherwise herein. Such rooms and spaces shall have smoke detectors. Provide sheet metal shielding below piping and sprinklers to protect sensitive electrical gear in these critical spaces from water discharge. Sleeve all piping routed thru elevator equipment rooms and switchgear rooms.

Exception - Sprinklers shall not be required in electrical equipment rooms where ALL of the following conditions are met:
1. The room is dedicated to electrical equipment only.
2. Only dry-type electrical equipment is used.
3. Equipment is installed in a 2-hour fire-rated enclosure including protection for penetrations.
4. No combustible storage is permitted to be stored in the room.

1.6 BASIS OF DESIGN

A. Occupancy Type(s):

1. **A-3** Assembly - Indoor Tennis Court (without spectator seating)
2. **S-2** **Storage** – Mechanical Room, Small Room Storage

B. Design Approach:

1. **Light Hazard** – Bathrooms, Tennis Courts:

a. Density: 0.10 gpm/sqft over a 1,500 sqft area of operation.
b. Sprinkler K-Factor: 5.6 or larger (per **NFPA 13: 12.6.1**)
c. Sprinkler Type: Pendent, Standard/Extended Coverage*, Quick Response.
d. Sprinkler Temperature Rating: minimum 150 deg. F
e. Spacing: maximum protection area of 225 sqft/sprinkler.
Small Room Rule (per **NFPA 13: 8.6.3.2.4**): permissible

*Extended Coverage: spaced per **NFPA 13: Table 8.8.2.1.2**

2. **Ordinary Hazard Group I** - Mechanical Rooms, Electrical Rooms, Small Storage Rooms:

a. Density: 0.15 gpm/sqft over a 1,500 sqft area of operation.
b. Sprinkler K-Factor: 5.6 or larger (per **NFPA 13: 12.6.1**)

c. Sprinkler Type: Pendent and/or Upright, Ordinary Hazard, Quick Response (per **NFPA 13: 8.3.3.2**) or Standard Response.
d. Sprinkler Temperature Rating: minimum 150 deg. F (per **NFPA 13: 8.3.2.7**)
e. Spacing*: maximum protection area of 130 sqft per sprinkler (per **NFPA 13: Table 8.6.2.2.1 (b)**)

*Extended Coverage: spaced per **NFPA 13: Table 8.8.2.1.2**

C. All piping shall be hydraulically sized for the available water supply based on sprinkler demands. Flow test data shall be obtained by the installing contractor and submitted to project engineer/designer prior to generating shop drawings.

D. A complete set of hydraulic calculations shall be submitted based on the final piping layout. Final hydraulic calculations shall be based on a maximum required pressure at flow conditions 15 psi below the curve established by the flow test data. Allow (250 gpm for Ordinary Hazard Occupancies) and (100 gpm for Light Hazard Occupancies) hose allowance assigned at the base of the sprinkler riser in calculations.

E. Calculations shall be based on sprinkler "K" factors of 5.60 for a 1/2" orifice, 8.0 for a 17/32" orifice, 11.2 and 25.2 for a 5/8" orifice. No more than four fittings shall be used in the drop nipples to pendent sprinklers.

F. Provide additional fittings and offsets as required to coordinate the work with other trades.

PART 2: PRODUCTS

2.1 MATERIALS

A. Unless noted otherwise, all materials shall be new and free from defects.

B. Materials and equipment used for similar application shall be the products of one manufacturer unless noted otherwise.

2.2 UNDERGROUND PIPE AND FITTINGS

A. Underground pipe: underground piping shall be ductile iron.

B. Ductile iron pipe: thickness class 50 with cement lining and bituminous coating, meeting FM 1610 *Ductile Iron Pipe and Fittings, Flexible Fittings and Couplings*, and ANSI A21.51. Joints shall be gasketed slip-on type, meeting ANSI A21.11.

C. Underground fittings: underground fittings shall be cement-lined cast iron with mechanical joint connections. Working pressure shall be 250 psig. Fittings shall meet FM 1620 *Pipe Joints and Anchor Fittings for Underground Fire Service Mains*, ANSI A21.10 and A21.11.

D. Tie rods and clamps: carbon steel rods with bituminous coatings. Provide 3/4" tie rods, bolts, and washers.

E. Underground gate valves: valves shall be suitable for use with an indicator post (PIV) or roadway box as noted on the drawings. Valves shall be non-rising stem gate valves with cast iron body, bronze mountings, and mechanical joint connections. Valves with indicator post shall have an indicator post flange. Valves shall open counterclockwise.

F. In-Building Riser (aka Transition Riser): designed in accordance to NFPA 24, the factory-tested riser shall be composed of a single 90-degree fitting of fabricated 304 stainless steel tubing with a maximum working pressure of 200 psi. The In-Building Riser shall be an Ames Fire and Waterworks Series IBR, or a Watts Series TR, or a Zurn Model WBR.

1. Inlet (underground side): Coupler shall be Push-On AWWA C900 (PVC or ductile iron pipe) and brackets shall be provided for pipe installation equipment attachment points.
2. Outlet (building side): shall meet AWWA C606 dimensions for roll-grooved pipe.
3. Pipe Wrap: entire length of fitting shall be primed and wrapped in minimum 4" wide, 20 mil thick, high-tack, corrosion resistant PVC tape which meets IAPMO PS 37-90. Acceptable manufacturers are: NADCO Product # PWT-20, or PASCO Part # 9064-R.

2.3 ABOVEGROUND PIPE AND FITTINGS

A. Above ground pipe shall be black steel:

1. For wet pipe systems piping shall be black steel to meet ANSI/UL 852 *Metallic Sprinkler Pipe for Fire Protection Service*, FM-1630, ASTM A795, ASTM A-135 or ASTM A-53. All pipe less than Schedule 40 shall meet ASTM A-135. <u>All pipe 1-1/4" and smaller shall be Schedule 40.</u> All pipe lighter than Schedule 30 shall be all be UL listed and FM approved and shall be joined by welding or Victaulic roll grooved couplings only (no threaded joints). Acceptable manufacturers are: Youngstown Tube Co., Allied Tube and Conduit, Wheatland Tube Co., Northwest Pipe Company, Paragon Industries Inc., Tex-Tube Company, and Bull Moose Tube Company.
2. Use hot dipped zinc coated (galvanized) pipe where noted (GALV.) on the drawings and as specified hereafter.
3. Galvanized pipe shall be installed in areas exposed to weather or corrosive conditions (i.e. pools, pool chemical storage, chemical storage, exterior piping etc.) and shall meet ASTM A-123 and ASTM A795/A795M - 13, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*.
4. DRY PIPE: All grooved end galvanized steel piping systems for pre-action and/or dry pipe systems shall be cut grooved in accordance with Victaulic specifications in accordance with AWWA C606. Coupling gaskets for pre-action and dry pipe systems shall be Flush Seal (Gap) or GapSeal type and shall be provided by the coupling manufacturer.

    a. No malleable iron fittings shall be used in pneumatic (dry or preaction) piping systems.

B. Malleable iron threaded fittings: material shall conform to ASTM A197, dimensions shall conform to ASME B16.3, NPT threads shall conform to ASME B1.20.1 and rated to 300# WSP. Acceptable manufacturers are Anvil ("SPF"), Allied Rubber & Gasket Co. (ARGCO), Sigma, Smith-Cooper ("SCI"), Tyco, Ward Manufacturing LLC, or approved equivalent.

C. Ductile iron threaded fittings: castings shall conform to ASTM A536, dimensions shall conform to ASME B16.3, NPT threads shall conform to ASME B1.20.1 and rated to 300# WSP. Acceptable manufacturers are Smith-Cooper ("SCI"), AnvilStar ("SPF"), Allied Rubber & Gasket Co. (ARGCO), Sigma, Tyco, or approved equivalent.

D. Cast iron threaded fittings: shall be U.L. Listed and FM approved for 300 psi service. Gray iron per ASTM A126 class B. Dimensions conform to ANSI B16.4 class 125 (plugs and bushings conform to ASME B16.14) and rated to 125# WSP. NPT threads per ANSI/ASME B1.20.1. Acceptable manufacturers are Smith-Cooper, Star, AnvilStar, Sigma, Ward Manufacturing LLC, or approved equivalent.

E. Welded fittings: Factory fabricated wrought steel buttweld fittings meeting ASTM A-234 and ANSI B16.9. U.L. listed and FM approved formed steel welding outlets may be used. Acceptable manufacturers are Wheeling Machine Products Company, Anvil, or Allied Piping Products Company.

F. Grooved joints and fittings:

1. Grooved mechanical fittings and couplings shall use an elastomeric gasket (EPDM or nitrile) enclosed by a split ductile iron housing.

   a. All wet pipe systems shall be roll-grooved type.
   b. All dry systems shall be cut groove type.
      Exception: coupling systems installed with Flush Seal (Gap) type gaskets may be roll-grooved type.

2. Ductile iron shall meet ASTM A-536.
3. Self-grooving couplings and fittings employing set screws or plain end pipe shall not be used.
4. **Ductile iron grooved fittings:** coatings shall be non-lead orange paint. Acceptable manufacturers are Allied Rubber & Gasket Co. (ARGCO), AnvilStar ("SPF"), API International (KLAMPz), Munro, Reliable, Shurjoint, Sigma, Smith-Cooper ("SCI"), The Viking Corp (VGS), Tyco, or Victaulic.
5. **Rigid type couplings:** Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. 1-1/4" through 8" shall be "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Acceptable manufacturers: Anvil Gruvlok 7400 S or Rigidlite 7400, Allied Rubber & Gasket Company (ARGO) Model 001, API International Model K05 KLAMPz, Dixon Valve & Coupling Co 402R, GemLock - Style 5, Reliable Automatic Sprinkler Company (RASCO) Model RRC, Shurjoint Model 7771, Smith-Cooper International (SCI) Model 65LR and/or 65SR, Viking V-Z05, Tyco Figure 577, Victaulic FireLock® EZ Style 009H (1-1/4" – 4") and QuickVic™ Style 005 (2" – 8"). 10" and larger shall be Victaulic Style 07 standard rigid coupling.
6. **Reducing couplings:** Shall be allowed only where one pipe size change occurs. Use reduction pipe fittings where change of more than one pipe size occurs. Acceptable reducing coupling manufacturers are: Allied Rubber & Gasket Company (ARGO) Model 020, Anvil International SPF RC2 or Figure 7010, Reliable Automatic Sprinkler Company (RASCO) Model RRDC, Shurjoint Model 7706, Smith-Cooper International (SCI) Model 65RC, Viking V-7706, Tyco Figure 716, and Victaulic Model 750.
7. Galvanized fittings shall be installed in all corrosive areas (i.e. areas exposed to the elements, pools, pool chemical storage, chemical storage, etc.)

G. **Mechanical tees:** shall provide a mid-point branch outlet (either threaded or grooved) without the use of multiple fittings or the welding method. A hole shall be cut or drilled – torch cutting is prohibited – before the mechanical tee is installed in accordance with the manufacturer's installation instructions. Mechanical tees shall be supplied with a Grade "E" EPDM gasket a pair of bolts and nuts. Removed pipe section shall be tethered to mechanical tee.

2.4 VALVES

A. All valves shall be by one manufacturer.

B. All valve handwheels shall be oriented to provide maximum accessibility for operation.

C. Use of quick-opening valves is not permitted on main drains or test headers.

D. Valve size, working pressure, and the manufacturer's name or trademark shall be permanently affixed to the body of all valves. Drain, test and gauge valves are exempt from this requirement.

E. "Standard weight" valves for service up to 175 psig, as follows:

1. Gate valves smaller than 2½" shall be U.L. listed OS & Y (rising stem) design with bronze body and mountings and screw connections.

2. Gate valves 2½" and larger for above ground service shall be U.L. listed OS & Y design with cast iron body, bronze mountings and flange connections. Open counterclockwise.
3. Grooved end gate valves 2½ " and larger for above ground service shall be U.L. listed and FM approved OS&Y design with ductile iron body, EPDM coated cast iron disc, bronze mountings and grooved end connections. Victaulic Series 771.
4. Trim valves: gate, globe, angle, and check valves used for "trim" in the fire protection system shall have all bronze construction and screwed connections.
5. All system shut-off valves shall be electronically supervised/monitored.

F. Swing Check Valves (grooved or flanged) shall be U.L. Listed and FM Approved, non-slamming, clapper type with ductile iron body (ASTM A 536, Grade 65-45-12), or cast iron body (ASTM A 126) and have an EPDM clapper facing, and stainless steel seat ring, hinge pin, and spring, and approved for horizontal or vertical installation:

1. Smaller than 2": shall have cast bronze body (85-5-5-5), forged brass clapper, NBR (Chloramine Resistant) seat, and female/female screwed connections.
2. 2" to 5": Clapper shall be Type 304 or 302 Stainless Steel (ASTM A167 or A 240)
3. 6" to 8": Clapper shall be ductile iron (ASTM A 536, Grade 65-45-12).
4. Acceptable manufacturers are: Anvil Fig. 78FP, ARGCO ARG-CH-300 Series, FPPI, Fivalco Inc. Firecheck DGC, Globe Model RCV, NIBCO KG 900 Series, Reliable Model G, Tyco Model CV-1, United Water Products Series 8700, Victaulic Series 717, Viking Model SCG, SCF, M-2, D-1, or G-1, or Ward MFG.

G. Wafer check valves shall be UL Listed and FM approved for fire protection service. Valves shall have stainless steel spring and hinge pins, and be ductile iron ASTM A 536 with Nitrile resilient seat molded to body, or cast iron ASTM A126 Class B with EPDM seat. Acceptable manufacturers are: Anvil, Allied Rubber & Gasket Co (ARGCO), Cla-Val Co Series 582G or 582W, NIBCO Inc., Global Safety, Globe Fire Sprinkler Corp., Kennedy, Central, Reliable Automatic Sprinkler Co Inc. Model REL-BFW-300, Victaulic, or approved equivalent.

H. Ball Valve: shall be full port, gear operated, lead free, slow close type. Acceptable manufacturers are:

1. Ames: model LFAFBV-FP
2. Smith-Cooper International
3. The Viking Corp: model FBV-FP
4. Victaulic
5. Watts

I. Butterfly valves shall be U.L. listed and FM approved for fire protection service. Valves 3” and larger shall be slow closing ductile iron body, flanged or grooved to fit piping system, 175 psi working pressure rated, stainless stem and ductile disc, EDPM or Viton resilient seat. Valves shall be provided with gear operation with malleable iron wheel. All valves shall be provided with a built-in tamper resistant SPDT switch for supervision of the valve position. Acceptable manufacturers are:

1. Anvil (Star Pipe aka S.P. fittings)
2. Allied Rubber & Gasket Co (ARGCO)
3. Fire Protection Products Inc. (FPPI)
4. FireWall Valve LLC: model F-W300 or F-G300
5. Fivalco Inc.
6. Gala RS Inc.
7. Global Safety
8. Globe Fire Sprinkler Corp.: Model GBV300GT
9. Kennedy
10. Landsdale International LLC
11. Milwaukee Valve Company Inc.

12. NIBCO Inc.
13. Reliable Automatic Sprinkler Co. Inc.: Model REL-BFG-300
14. Smith-Copper International
15. Tyco Model BFV-N
16. Victaulic
17. Zurn: Model 49

J. Alarm Check Valve (Riser Check Valve): Cast iron, bronze trimmed alarm check valve with vertical, variable pressure trim. Provide an exterior water or electric motor alarm. Acceptable manufactures:

1. Globe Model RCV (with electric alarm bell) and Model H
2. Reliable Model E or Model G with Trim Kit
3. Victaulic Series 751/764
4. Viking Model E-1, F-1, OR J-1
5. Shurjoint RCV
6. Tyco Model AV-1, CV-1 or CV-1FR

K. Dry Pipe Valve: Iron body, flanged, 175 psi rated with replaceable clapper assembly, complete with trim, accelerator pressure alarm switch, and low pressure switch. Valve shall be Globe Model D, Reliable Model D, Viking Model F, or Tyco Model DPV-1, or Victaulic Series 756/768/764.

1. Pressure Switch (Water): switch shall be provided with a 1/2" NPT male pressure connection and shall be connected to the alarm port outlet of dry pipe valve. The pressure switch shall be actuated when the alarm line pressure reaches 4 - 8 psi. Pressure type waterflow switch shall have a maximum service pressure rating of 300 psi and shall be factory adjusted to operate on a pressure increase of 4 - 8 psi. Pressure switch shall have two sets of SPDT rating 10.1 Amps @ 125/250VAC or 2.0 Amps as 30VDC (verify with electrical contractor). Pressure switch shall be suitable for indoor or outdoor service with a NEMA 4/IP66 rating.
2. Pressure Switch (AIR): switch shall be provided with a 1/2" NPT male pressure connection and shall be connected into the air supply line on the system-side of any shut-off valve. Pressure switch shall have two sets of SPDT rating 10.1 Amps @ 125/250VAC or 2.0 Amps as 30VDC (verify with electrical contractor). The first switch shall be set to operate at a pressure decrease of 10 psi from normal. The second switch shall be set to operate at a pressure increase of 10 psi from normal. Pressure switch shall be suitable for indoor or outdoor service with a NEMA 4/IP66 rating.

L. Test and Drain Valve: Globe style bronze body and bonnet, bronze and copper alloy internals with stainless steel spring, dual polycarbonate sight glasses, ½” orifice for test purposes (note: orifice size shall be equal to the smallest sprinkler orifice provided on the system), and stainless steel quarter-turn ball valve or a malleable iron handwheel. UL listed and FM approved for services up to a minimum of175 psi. ARGCO Model 1000, Giacomini A61, Globe Model UTD, Tyco TFP F350, Victaulic Series 720 TestMaster™ II, Viking Test and Drain Model 1000, or AGF TESTanDrain Model 1000 or Model 1011A (for gridded systems).

M. Remote Test and Drain Valve: Globe style bronze body and bonnet, bronze and copper alloy internals with stainless steel spring, dual polycarbonate sight glasses, ½” orifice for test purposes (note: orifice size shall be equal to the smallest sprinkler orifice provided on the system), and stainless steel quarter-turn ball valve or a malleable iron handwheel. UL listed and FM approved for services up to a minimum of 175 psi. Giacomini A61, Tyco TFP F350, Victaulic Series 720 TestMaster™ II, Viking Test and Drain Model 1000, or AGF TESTanDrain Model 3011SG or Model 3011ASG (for gridded systems).

2.5 SPRINKLERS

A. All sprinklers shall be listed and shall be the product of one manufacturer.

B. All sprinklers up to K-Factor 5.8 shall have 1/2" NPT threaded connections unless otherwise noted. All sprinklers with K-Factor 8.0 or greater shall have 3/4" NPT threaded connection, unless otherwise noted.

C. Sprinklers shall be listed for their specific use and of the following manufacturers: Globe Fire Sprinkler, Reliable Automatic Sprinkler, The Viking Corporation, Tyco Fire Products, or Victaulic Company. See table(s) below for FM Global approved model numbers:

	Pendent Sprinklers									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5651	GL5601	R1314	R1414	VK102	VK302	TY325*	TY323*	V2707	V2708
K5.6EC						VK600		TY3232		
K8.0	GL8156	GL8106	R1712	R3612	VK202	VK352	TY4251	TY4231	V3405	V3406
K8.0EC				R4842		VK602		TY4232		
K11.2			R2916	R3216	VK536	VK377	TY5251	TY5231	V3407	V3408
K11.2EC						VK608		TY5237	V3411	V3412
K14.0			R4613	RA1812		VK500		TY6236		V4402
K14.0EC						VK572		TY6237	V3414	
K25.2				RA0912		VK510		TY9226	V4601	
K25.2EC				RA0842						
*Tyco TY-B and TY-FRB old serial # TY3231 & TY3251										

	Recessed Pendent Sprinklers									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5651	GL5601	R1314	R1414	VK102	VK302	TY325*	TY323*	V2707	V2708
K5.6EC										
K8.0	GL8151	GL8101	R1712	R3612	VK202	VK352	TY4251	TY4231	V3405	V3406
K8.0EC				R4842		VK602		TY4232		
K11.2										
K11.2EC						VK608		TY5237	V3411	V3412
K14.0										
K14.0EC								TY6237	V3414	
*Tyco TY-B and TY-FRB old serial # TY3231 & TY3251										

	Upright Sprinklers									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5661	GL5615	RA1325	RA1425	VK100	VK300	TY315*	TY313*	V2703	V2704
K5.6EC										
K8.0	GL8164	GL8118	R1722	R3622	VK200	VK350	TY4151	TY4131	V3401	V3402
K8.0EC										
K11.2			R2921	R3226	VK530	VK531	TY5151	TY5131	V3403	V3404
K11.2EC						VK532		TY5137		
K14.0						VK520				
K14.0EC								TY6137		
K25.2					VK598				V4603	
K25.2EC						VK595		TY9128		
*Tyco TY-B and TY-FRB old serial # TY3131 & TY3151										

	Horizontal Sidewall Sprinklers									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5670	GL5626	RA1335	RA1435	VK104	VK305	TY3351	TY3331	V2709	V2710
K5.6EC				RA2865				TY3332		V2758
K8.0										
K8.0EC				R4862				TY4332	V3415	V3416

	Dry Pendent Sprinklers*									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5679	GL5635	RA5314	RA5714	VK150	VK172	TY3255	TY3235	V3605	V3606
K8.0									V3607	V3608
K11.2					VK544	VK547				
K14.0						VK502				
*Provide dry pendent sprinklers in areas with finished/drop ceilings, to minimize volume of trapped water in dry pipe systems.										

	Dry Adjustable Pendent Sprinklers*									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6					VK154	VK176				
K11.2					VK546	VK549				
*Provide dry pendent sprinklers in areas with finished/drop ceilings, to minimize volume of trapped water in dry pipe systems.										

	Dry Recessed Pendent Sprinklers*									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5679	GL5635	R5314	R5714	VK158	VK180	TY3255	TY3235	V3605	V3606
K8.0									V3607	V3608
K11.2					VK545	VK548				
*Provide dry pendent sprinklers in areas with finished/drop ceilings, to minimize volume of trapped water in dry pipe systems.										

	Dry Horizontal Sidewall Sprinklers									
Nominal K-Factor	Globe Fire Sprinkler Co.		Reliable Automatic Sprinkler Co.		The Viking Corp.		Tyco Fire Products		Victaulic Co.	
	Standard	QR	Standard	QR	Standard	QR	Standard	QR	Standard	QR
K5.6	GL5685	GL5641	R5334	R5734	VK152	VK174	TY3355	TY3335	V3609	V3610

D. Recessed sprinklers:

1. In all lay-in ceilings, unless otherwise noted. Finish shall be white painted/polyester with matching escutcheons/cover plates, unless otherwise noted.
2. In all metal, wood, wood-like ceilings. Finish shall be chrome, unless otherwise noted.
3. All escutcheons installed with recessed sprinklers shall be two-piece semi-recessed mounted.

E. Upright sprinklers:

1. Install upright sprinklers in all areas exposed to structure.
2. All upright sprinklers shall be cast brass finish, unless otherwise noted.

F. Sidewall sprinklers:

1. Finish color shall match wall finish color (painted by manufacturer only).

G. Temperature ratings shall be as recommended by NFPA 13 unless shown otherwise.

H. Install near the alarm valve a painted steel cabinet containing spare sprinklers and one sprinkler wrench. Contractor shall include at least one pair of escutcheons for each type of spare sprinkler. Proportion sprinklers as to type and temperature rating. If flexible sprinkler drops are used, provide a spare flexible drop strapped to the spare sprinkler cabinet with an additional mounting bracket and lock nuts. The stock of spare sprinklers shall include all types and ratings installed and shall be as follows:

1. For protected facilities having under 300 sprinklers — no fewer than six sprinklers

I. Install sprinkler guards on all sprinklers located within 7'-0" of finished floor. Acceptable manufacturers are: Globe Model JG, Reliable Model C-1, Tyco Model G1or Model G4, Viking Model A-1 or Model D-1, or Victaulic Model V27 or Model V34.

J. In areas where sprinklers are subject to high velocity impacts (i.e. tennis courts.), sprinkler guards shall be heavy duty steel construction type, approximately 4” W x 3” H for 1/2” or 3/4" NPT sprinklers. White or chrome finish. Acceptable manufacturers are: SprinkGUARD ThreadGUARD

K. Special coatings: sprinklers installed in areas exposed to weather or corrosive conditions (i.e. pools, chemical storage, etc.) shall have a manufacturer NICOTEF (Nickel-Teflon) coating. Acceptable manufacturers are: Victaulic and Viking.

L. Sprinkler escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler, by the sprinkler manufacturer.

2.6 FLEXIBLE SPRINKLER DROPS

A. In lieu of rigid pipe offsets or return bends for sprinkler drops, a flexible sprinkler drop may be used (i.e. ARGCO braided flex, EasyFlex, Fivalco, SprinkFlex, Reliable (RASCO) Flexible sprinkler drops, Victaulic VicFlex™, Viking braided flexible sprinkler connection, Tyco FASTFLEX Braided-FM, or FlexHead) provided the suspended ceiling supporting the flexible sprinkler drop meets ASTM C 635 and is installed in accordance with ASTM C 636 and the maximum unsupported length of the flex drop does not exceed 6 ft.

B. VicFlex Style VS1 Dry Sprinkler Model V3506 (with white painted finish):

1. The Style VS1 Dry Sprinkler's inlet MUST be installed only into the outlet of a cast or malleable iron tee that meets the dimensional requirements of ANSI B16.3 and ANSI B16.4, Class 125 and Class 150. Use a sample fitting to confirm proper engagement.
2. Style VS1 Dry Sprinklers in dry systems must be installed with a continuous downward slope along its entire length from the branch line fitting to the sprinkler. No localized low points shall be present along the length of the Style VS1 Dry Sprinkler.
3. Style VS1 Dry Sprinklers are not permitted to be installed into the top of the branch line piping. Style VS1 Dry Sprinklers must be installed into the side or from the bottom of the branch line piping.

C. The drop system shall consist of a <u>fully braided</u> type 304 stainless steel flexible tube, a zinc plated steel 1" NPT male threaded nipple for connection to branch-line piping, and a zinc plated steel reducer with a 1/2" or 3/4" NPT female thread for connection to the sprinkler head.

D. The flexible drop must be listed for a minimum of three 90 degree bends to assure proper installation. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate bracket (the bracket shall allow for sprinkler installation before or after the bracket is secured to the sprinkler grid). The braided drop system is FM Approved for sprinkler services to 175 psi and can be installed without the use of proprietary tools, and the corrugated system is UL Listed for sprinkler services to 175 psig. All hoses shall be factory-pressure tested to a minimum of 400 psi.

E. Equivalent lengths: shall be based on FM approved equivalent lengths for submitted flexible hose length. Flexible hose length (or lengths) shall be specifically indicated in both the product data submittal and on the shop drawing(s).

2.7 HANGERS AND SUPPORTS

A. The installation and spacing of hangers for sprinklers shall conform to NFPA 13.

B. Hangers and supports shall be U.L. listed and FM approved and suitable for the structural system as recommended by the manufacturer.

C. Piping smaller than 8" shall be supported by galvanized steel, adjustable, flat band hangers. Acceptable manufacturers are AFCON model 300, Anvil Fig. 69, Globe Pipe Hanger 300 Series, PHD Manufacturing, Inc., ERICO Caddy, B-Line, Inc. (TOLCO), or approved equivalent.

D. Sprinkler piping below ductwork shall not be supported directly from the ductwork, but by trapeze hangers or angles conforming to NFPA 13.

2.8 ALARM AND SUPERVISORY DEVICES

A. Alarm switch for wet pipe systems: Vane-type flow switch with flexible vane, SPDT contacts, cast aluminum housing with red enamel finish, and a steel U-bolt. The switch shall have an instantly recycling pneumatic retard mechanism field adjustable from 0-60 seconds. Minimum water working pressure shall be 175 psig.

B. Valve tamper switch: Suitable for PIV alarm, or zone valves. A signal shall be initiated before the valve stem moves more than 1/5 of its total travel or if the housing cover is removed.

PART 3: EXECUTION

3.1 UNDERGROUND PIPE AND ACCESSORIES

A. Underground pipe shall have not less than 36" cover.

B. Excavate the trench bottom around pipe joints so that the pipe rests on solid ground along its entire length.

C. Rock, sand, unstable soil, or material unsuitable to bear pipe shall be excavated to a minimum depth of 6" below the bottom of the pipe and the space filled with gravel.

D. Pipe trenches shall be backfilled and tamped in 6" layers until the crown of the pipe has been covered. Backfill shall contain no rocks, refuse, or cinders.

E. Underground pipe shall terminate in the building with a flanged cast iron transition piece rodded to the underground pipe. Space between the pipe and wall shall be filled with non-shrink grout. Where pipe passes through the building wall below outside grade, provide a cast iron sleeve and fill the annular space between pipe and sleeve with a "Link-Seal" mechanical type, synthetic rubber seal manufactured by GPT Industries.

F. Prior to connection of inside piping, new underground pipe shall be flushed at a rate of 1000 gpm until all foreign matter is blown out and the stream runs clear.

G. Prior to covering the joints of underground pipe, the pipe shall be hydrostatically tested for two hours at a pressure of 200 psig. Leakage allowance shall be within the limit specified in NFPA 24. The municipal water main and the plumbing system shall be isolated for this test.

H. Changes in direction exceeding 22.5 degrees shall be anchored with thrust blocks, tie rods, and clamps per NFPA 24.

I. Underground piping systems for city water applications may utilize Victaulic grooved mechanical couplings and fittings for joining AWWA dimensioned ductile iron pipe, minimum Class 53, with radius cut grooved ends conforming with Victaulic grooving specifications in accordance with ANSI/AWWA C606.

J. To minimize erosion/washout, provide splashguard at each exterior drain location where drain terminates over natural grade (i.e. sod, planting bed).

3.2 INSIDE PIPING AND EQUIPMENT

A. Fire protection valves shall be accessible and shall not be located in the fire area they control. Valves should be in an area easily accessible under all conditions. Locations above suspended ceilings shall be avoided with the exception of valves which control a single sprinkler (i.e. elevator pit sprinkler). Fire protection valves shall be located in stairwells, or in stacked sprinkler or mechanical spaces which permit ready access and floor to floor riser piping. Fire protection valves shall not be located in custodial closets or customer closets or conference rooms. If no other option is available, valves located above ceilings shall be accessible and labeled on the ceiling grid or access panel.

B. Route sprinkler piping to provide a finished system located above finished ceilings, where ceilings are installed.

C. DO NOT route new sprinkler piping under HVAC units or within HVAC unit service access, coordinate with mechanical contractor for unit locations prior to beginning work.

D. Run pipe parallel to column centerlines. Pipe shall generally be installed as high as possible to maintain maximum headroom. Provide auxiliary drains as needed to drain all portions of the piping systems.

E. Piping arrangements shall be made as compact as possible. Spool pieces and pipe nipples shall be as short as installation with allow.

F. All piping shall be routed to provide clearances for servicing and removal of mechanical equipment.

G. Use galvanized piping for ball drip discharges, drains subject to alternate wetting and drying, and water motor piping. Use galvanized fittings for all piping systems where galvanized piping is required.

H. Threads on fittings and bolts shall be fully engaged. At least two threads shall be visible through the nuts of all bolted connections. Threads shall be made up using approved joint compound or tape.

I. No sprinkler shall be located closer than 6" from an adjacent wall.

J. Sprinklers shall be visibly aligned on the ceiling and centered in the tiles. Sprinkler escutcheon plates shall be set tight against the ceiling.

K. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors

L. All drains shall be piped to spill over the nearest floor drain or as noted on the plans. Exterior drain piping shall exit the building no higher than 12 inches above finished dirt grade, or 6 inches above finished concrete. All exterior drain pipe and associated fittings shall be galvanized.

M. Torch cutting is not permitted as a means of modifying sprinkler or standpipe systems.

N. Automatic air vent shall be located off the top of horizontal piping at high point of the system.

O. Install grooved joint fittings and valves per manufacturer's recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by Victaulic. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.3 HANGERS AND RODS

A. Hanger rod orientation: Piping hanger rods shall be installed perpendicular to the pipe it supports. *Exception: rods suspended from sloped ceilings/roofs shall be oriented to support the vertical load.*

B. Threaded rods may be bent to facilitate correct support orientation provided the rod is bent as close to the upper hanger component as possible. Rod bending is permitted only in a non-threaded section. When entire rod is threaded, a swivel assembly shall be used to achieve proper component orientation.

3.4 DRY SPRINKLERS

A. Provide dry pendant sprinklers at all locations subject to freezing (e.g. vestibules, cold storage coolers, exterior stairwells, etc.). Where dry sprinklers are not possible, use an auxiliary piping system.

B. Provide dry horizontal sidewall sprinklers in rooms dedicated to electrical equipment (i.e. Electrical Rooms, IT Rooms/Server Rooms (less than 260 sqft), Hub Closets, etc.). Sprinkler piping, wet or dry, through/over these areas is prohibited. Dry horizontal sidewall sprinkler(s) shall be connected to wet pipe system serving adjacent space. Order length shall be no less than 8".

3.5 TESTS AND INSPECTIONS

A. All tests and inspections of the system and its components shall be conducted as per NFPA 13 and witnessed by representatives of the Architect, the engineer, the installer, the local fire department (at their discretion), and the Insurance and Regulatory Agencies at a time coordinated between all parties. A minimum of five days notice shall be given than the system is ready for tests. *Note: the General Contractor may act as a representative witness for the project engineer to ensure underground pipe and water entry locations are installed as specified.*

B. Wet Pipe Systems: Each portion of the interior piping shall be hydrostatically tested for two hours at 200 psig measured at the bottom of the system. All leaks shall be repaired until the system is tight for two hours.

C. Final inspection shall include operation of all water flow detection devices, alarm valves, and drains.

D. The Contractor shall submit a report recording test results, switch settings, and witnesses. Material and Test Certificates, as indicated in NFPA 13, shall be completed and submitted for all piping systems.

3.6 IDENTIFICATION SIGNS AND RECORD PLANS

A. General Information Sign: The installing contractor shall provide a general information sign per **NFPA 13: 25.6.** (ref NFPA 13: *Figure A.25.6*)

B. Sprinkler List: A list of installed sprinklers shall be posted in the sprinkler cabinet. (Per **NFPA 13: 6.2.9.7.1**)

C. Valve Tags: All sprinkler valves shall be tagged with a numbered metal tag as specified in Section 21 05 53. In addition, all auxiliary drain and inspectors test valves shall have a 2"H x 6"W red sign with white letters "AUXILIARY DRAIN" or "INSPECTORS TEST". Acceptable manufacturers: ARGO, Seton Identification Products, Emedco, Tyco Type B, Brooks Equipment, or approved equal.

D. On-site Record Plans: One clean copy of all sprinkler working plans shall be sealed in a plastic envelope and attached to the wall near sprinkler riser.

E. Installer shall permanently mount signage indicating system hydraulic design and water supply demands.

1. Hydraulic Data Nameplate: Attach engraved aluminum placard/nameplate, or plastic placard, or vinyl with adhesive back (inked with permanent marker) to the base of each sprinkler riser with design flow and pressure for the system. Acceptable manufacturers: ARGO Item #50-10-240 or Item #50-20-240, Seton Identification Products Style No. 91246 or Style No. 98139, Emedco Part No. SHS300, Brooks Equipment Part No. A232, Tyco Type E, or approved equal.

END OF SECTION

SECTION 21 00 10
GENERAL PROVISIONS – FIRE SUPPRESSION

PART 1 GENERAL

1.01 DESCRIPTION

A. These Mechanical General provisions specified herein apply to all Sections of Division 21.

1.02 WORK INCLUDED

A. Provide all materials, labor and services as specified in Division 21 and shown on the accompanying drawings.

1.03 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Conditions, and are applicable to all Fire Suppression Sections.
   1. Provide: Furnish, install and connect completely.
   2. Piping: Pipe installed with all required fittings, valves and accessories, and forming a complete system.
   3. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, and accessories completely installed.
   4. Power Wiring: Wiring which supplies the electrical current which flows through a connected motor or heater.
   5. Exposed: Revealed to view or subject to weather.
   6. Control, interlock and starting circuit wiring: All wiring required by all Mechanical Sections that is not power wiring.
   7. Fittings: All connecting pieces of a system.

B. Drawings: The Mechanical Drawings are diagrammatic except where specifically indicated otherwise. Refer to Architectural and Structural Drawings for building dimensions.

C. Materials: Refer to the General Conditions. All material shall be suitable for the service and operating conditions of this Specification.

1.04 ABBREVIATIONS

A. The following abbreviations are used in this Division of the Specifications:

ASTM - American Society for Testing Materials.
ASME - American Society of Mechanical Engineers.
NFPA - National Fire Protection Association.
ANSI - American National Standards Institute.
NEMA - National Electrical Manufacturers Association
UL - Underwriters Laboratories, Inc.
AWWA - American Water Works Association.

1.05 APPLICABLE CODES

A. All work shall be in strict accordance with Floyd County Requirements, including the latest Georgia State Fire Commissioner's Rules and Regulations, and the latest adopted Georgia Department of Community Affairs Mandatory Codes.
   1. International Building Code, 2012 Edition, with Georgia Amendments (2014) (2015) (2017).
   2. International Fire Code, 2012 Edition, with Georgia Amendments (2014).
   3. National Electrical Code, 2017 Edition. (No Georgia Amendments)
   4. All City, County, State, Regional, and other ordinances applicable to the work shall apply.

1.06 RELATED WORK

A. The following work is generally specified in other Divisions of the Specifications, except as specifically otherwise stated in this Division.
   1. Electric power wiring.
   2. Painting.
   3. Installation of access panels in walls and ceiling construction.

4. Installation of starters, contactors, thermal overload switches, and remote push buttons.
5. Furnishing and installation of motor control center.
6. Cutting and patching of walls, floors, ceilings, roofs, and structure of existing buildings.
7. Demolition.
8. Excavation.
9. Trenching and backfilling.

1.07 SPACE CONDITIONS

A. All work shall fit the spaces available. Verify all dimensions of the work before commencing fabrication and/or installation.

B. Minor deviations from the drawings required to conform to space conditions and to provide the required operation, service, or maintenance accessibility shall be made at no additional cost, and subject to approval.

C. Piping or equipment shall not be installed in electrical equipment rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panel boards, power panels, motor control centers, or dry type transformers:
   1. Within 42" in front (and rear if free standing) of equipment; or
   2. Within 36" of sides of equipment
   3. Clearances apply vertically from floor to ceiling structures.

D. Hydronic piping shall not be installed above any electrical or control panels.

1.08 RECORD DRAWINGS

A. Upon completion of the Project, the Contractor shall submit one set of contract prints with red marks indicating As-built conditions of all piping, ductwork, and equipment, and incorporating changes made during construction. A record of as-built conditions shall be kept throughout the Project and shall be used in the preparation of the final record drawings.

B. The Contractor shall provide digital images (minimum resolution of 1152 x 864 pixels in JPEG standard image file format) delivered via email or on CD, of any utilities/piping that are installed underground with a reference drawing indicating which direction each picture is taken. The reference drawing shall dimension the utility/piping from a prominent fixed object.

1.09 GUARANTEES

A. Furnish a written guarantee covering each category of work for a period of one year from date of legal acceptance for the project. Guarantee shall include prompt correction of all leaks.

B. Guarantee shall be furnished in exact conformity with the requirements of the General Conditions.

1.10 BUILDING UTILITIES

A. Arrange with appropriate utility agencies for the connection of all utility services and pay all charges in connection therewith.

B. Fire water service shall connect into the street main.

C. The water meter shall be of the size shown on the drawings.

D. Where boring under city streets or state highways is required for connection to utilities, contractor shall confirm and follow requirements as outlined by authority responsible for utility systems. All costs for boring shall be paid by the contractor.

1.11 CONTINUITY OF SERVICE

A. All work shall be scheduled with that of other trades. The following conditions shall apply to all affected work.

B. Before disconnecting any existing systems for changes, the Contractor shall:
   1. Have all materials needed stored at the job site.
   2. Have assurance that all labor and skilled mechanics needed will be available at the proper time.
   3. Estimate the time the system will be out of service and inform the Owner in writing.

4. Secure approval of the shutdown dates from the Owner in writing before disconnecting the system.

C. Work shall be so conducted that the water supply and drainage of existing services will not be interrupted when such services are required for normal usage of the occupied portions of the existing building.

D. Work shall be done at such time and in such manner as to cause minimum inconvenience to the Owner and as approved by him or his representative. No allowance will be made for lack of knowledge of existing conditions.

1.12 OPERATING INSTRUCTIONS

A. Instructions: Instruct the Owner's representative in operation of the installed systems. The basis of these instructions shall be those written for inclusion in the maintenance and operating instruction data specified herein. Obtain certificates, signed by the Owner's representative, that these instructions have been received.

B. Notification: Notify the Owner at least five days before commencing operating period for refrigeration and heating equipment, as specified herein, in order that the Owner's representative may be present during that period.

1.13 DOCUMENTATION

A. Documents to be submitted prior to request for final inspection:
   1. Maintenance Manuals per Section 21 01 00 Operation and Maintenance of Fire Suppression.
   2. Three copies of multi-year warranties bound in a brochure with index listing equipment.

B. Data to be Delivered at Final Inspection:
   1. Record Drawings.
   2. Certificate by Owner's representative confirming that operating instructions have been received.

1.14 SUBMITTALS

A. Procedure: Refer to the GENERAL CONDITIONS and SUPPLEMENTS thereto for submittal procedure of items called for in the Contract Documents.

B. Submittal data covering the work of this Division will be reviewed only after such items have been reviewed in detail and approved by the Contractor, such approval being indicated by suitable notations or stamp on the data.

C. Each submittal shall be clearly marked indicating Section and paragraph for which it is intended. Any deviations, exclusions or substitutions from specified material requirements shall be specifically identified in a summary sheet at the front of the submittal.

D. Where submittal sheets contain multiple products or selections, the specific item being submitted for review shall be clearly indicated with a red arrow (stamped or hand written). “Catalog” submittals (multiple items contained in the submittal, specific items not identified) will be rejected and not reviewed.

E. Submit the requested submittals in sufficient quantity to provide two copies in addition to those required by Contractor.

F. All pump submittals shall include performance curves indicating flow, pressure, efficiency, and power requirements. For pumps, adjacent impeller selections shall be included.

G. Motor Tabulation on all motors furnished listing the following nameplate data: Horsepower, voltage, phase and full load amps.

H. Submittal List: See the individual Mechanical Specification Sections for specific submittal requirements.

1.15 SHOP DRAWINGS GENERAL

A. Shop drawings and calculations shall be meet NFPA 13 Chapter 23 *Plans and Calculations* requirements.

END OF SECTION

SECTION 21 01 00

OPERATION AND MAINTENANCE OF FIRE SUPPRESSION

PART 1 GENERAL

1.01 MAINTENANCE AND OPERATING MANUALS

A. Provide manual in number of copies indicated under Section 21 0010 General Provisions - Fire Suppression.

B. Material submitted in the manuals shall represent the equipment manufacturer, model, and type installed on the project.

PART 2 PRODUCTS

2.01 MAINTENANCE AND OPERATING MANUALS

A. Maintenance and Operating Manuals shall consist of the following as a minimum:
   1. Hardback three ring binders with job name and Owner's name on cover.
   2. Typed index listing name, address, and phone number of the General Contractor, Fire Protection Subcontractor, Controls Subcontractor, and all major equipment suppliers.
   3. Typed table of contents, listing each Section, title, and number.
   4. All Sections shall be tabbed with plastic tabs listing Section numbers.
   5. Each item of equipment requiring maintenance and operation data as noted in each specification section shall be provided with an index listing the types of equipment installed. Submittal data shall be included to the extent necessary to identify equipment, including summary sheet, such as model, size, air or water flow, pressure developed, speed, and motor size. Instructions shall include type and suggested frequency of maintenance, oiling, cleaning, disassembly, and reassembly directions, and wiring diagrams.
   6. One section shall include a complete set of record control drawings, bound in a plastic insert, full size, complete with a written sequence of operation for all control systems.
   7. Letters, where factory startup or checking has been required, certifying completion of performance.

PART 3 EXECUTION

3.01 MAINTENANCE AND OPERATING MANUALS

A. All maintenance and operating manuals shall be complete and ready to turn over to Owner's representative at final inspection.

B. Incomplete manuals will be returned to the Contractor for complete resubmission. Loose leaf submittal of material at various stages of completion will not be acceptable.

END OF SECTION

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section of specifications deals with materials and methods pertaining to all work specified under Division 21.

1.02 RELATED SECTION

A. Section 21 00 10 General Provisions Fire Suppression

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide submittal data showing starter dimensions, weight, electrical requirements, and service access requirements.

C. Provide submittal data showing motor horsepower, electrical requirements, and efficiency.

D. Provide submittal data showing firestop systems, including details for penetrations and instructions for installation

E. Provide manufacturer’s instructions, indicate installation and support requirements.

1.04 JOB CONDITIONS

A. Install all apparatus so as to maintain maximum headroom and clearances consistent with requirements of the drawings and specifications.

B. All equipment requiring service shall be installed to permit access for servicing without damage to building structure or finishes.

PART 2 PRODUCTS

2.01 SUPPORTS AND HANGERS

A. Hangers and pipe attachments for sprinkler systems shall meet the requirements of NFPA 13.

B. Hangers and pipe attachments, except where otherwise specified shall be Elcen, Michigan Hanger Company, B-Line, or Grinnell.

2.02 STRUCTURAL ATTACHMENTS

A. Structural attachments for sprinkler systems shall be in accordance with NFPA 13.

2.03 ASBESTOS

A. All materials used in this work shall be asbestos free.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be installed plumb and square unless clearly indicated otherwise. Installation shall be performed by competent persons, trained in their respective skills.

B. Furnish and install equipment complete, including connections, services and adjustments for systems to operate safely and in compliance with requirements of the contract.

C. Install each item in full compliance with current recommendations of the manufacturer. Equipment manufacturer or his authorized representative shall furnish services and/or supervision necessary to ensure compliance with this provision. Conflict between manufacturer's recommendation and other contract requirements shall be resolved before installation.

D. Requirements of the several acceptable manufacturers for each specified item of equipment may vary as to installation details, location and number of connections, dimensions and weight. Provide all drawings, services, material, and labor necessary for the installation and proper functioning of the equipment furnished.

3.02 PROTECTION OF MATERIALS AND EQUIPMENT

A. Take precautions to protect all materials and equipment from damage during the construction process.

B. Do not store materials and equipment outdoors subject to weather without complete weather protection.

C. Do not install materials or equipment in a partially constructed structure exposed to weather, unless all material and equipment is continuously protected from damage by weather or the construction process.

D. Material and equipment damaged by improper protection during construction is subject to replacement based on the judgment of the Engineer at no cost to the Owner.

3.03 CUTTING AND REPAIRING

A. Cut and repair all walls, floors, and ceilings necessary for the installation of the mechanical work, but no cutting of work of other trades will be permitted without the consent of the Architect or his representative.

B. All cutting and repairing of walls, floors, and ceilings shall be subject to the supervision and approval of the Contractor.

3.04 CLEANING AND FINAL CLEAN-UP

A. Keep the premises free of waste, debris and surplus materials.

B. After equipment has been installed, remove all extraneous materials, rust and stains; blow, vacuum or flush all foreign matter from all equipment.

C. Identification plates on equipment shall be free of paint and shall be polished.

3.05 EXCAVATION AND BACKFILL

A. Do all trenching, excavating and backfilling required for the Mechanical Sections. Include all necessary repairing, shoring, bracing, pumping and protection for safety of persons and property. Repairing shall be comparable to work cut and shall be approved by the proper authorities.

B. Slope sides of excavations to comply with OSHA regulations and local ordinances having jurisdiction. Shore and brace where sloping is not possible either because space restrictions or stability of materials excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

C. Care shall be taken to avoid existing facilities in excavating. Contractor shall be responsible for all damage to existing facilities in executing this work.

D. Excavate rock to depth of 6" below bottom of pipe. Space between rock and pipe shall be filled with sand.

E. Bottom of trenches shall be graded to secure the required fall. Size of bell holes for soil and sewer pipe shall be held to a minimum so that the entire pipe length rests on compacted fill or undisturbed earth.

F. Backfill shall be placed completely under pipe haunches and in bell holes and uniformly tamped in 6" layers. Backfill over top of pipe with select materials free of clods, stones, boulders, and foreign materials. Back fill shall not be installed until pipe is insulated, tested and field inspected by inspector.

G. Backfill shall be compacted to 95% of maximum dry density as determined by a Standard Proctor Test, ASTM-D698, except where under areas to be paved, top 12 to 24 inches of fill shall be compacted to 97% dry density by above standard.

3.06 PIPING SUPPORTS AND ANCHORS

A. Sprinkler piping shall be supported and anchored as required by NFPA 13.

3.07 HANGER SIZES

A. Hangers shall be sized to fit the pipe.

3.08 STRUCTURAL ATTACHMENTS

A. Inserts shall be used for individual loads exceeding 150 lbs. Concrete fasteners may be used where approved in writing by Architect for individual loads of 150 lbs. or less.

B. Inserts shall be secured to the forms before the pouring of concrete. In all spaces with exposed concrete ceilings, the openings not filled with rods and nut shall be filled with cement grout flush with the ceiling.

C. Shooting of fasteners into the slab shall be allowed only in approved locations.

D. Devices for connection to the structure shall not be loaded more than 75% of the manufacturer's rated load.

END OF SECTION

SECTION 21 05 53

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the identification requirements for the mechanical systems.

1.02 RELATED SECTIONS

A. Section 21 00 00 General Provisions Fire Suppression

B. Section 21 05 00 Common Work Results for Fire Suppression

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

C. Schedules: Submit valve schedule for each piping system, typewritten and produced on 8½" x 11" bond paper. Include valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and any variations for identification. If addition to framed copies, furnish extra copies for maintenance manuals as specified in Division 1.

1.04 SUMMARY

A. Section includes:
   1. Underground Warning Tape.
   2. Valve Tags and Schedules.
   3. Engraved Plastic Signs.
   4. Engraved Equipment Markers.
   5. Plastic Tags.

1.05 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A13.1 - 1996 Edition, *Scheme for the Identification of Piping Systems*.

B. Department of Labor 29 CFR 1910.1200.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification products of types and sizes required, whose products have been in satisfactory use for a period of five (5) years.

B. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification products.

PART 2 PRODUCTS

2.01 IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products for each application as referenced in this section.

2.02 UNDERGROUND TYPE PLASTIC LINE MARKERS

A. Metallic Piping: Provide manufacturer's standard non-detectable permanent, continuous printed plastic tape, intended for direct burial service, not less than 3" wide by 4 mils thick. Provide tape with printing most accurately indicating type of service of buried pipe.

2.03 VALVE TAGS

A. Tags: provide permanently marked weatherproof metal or rigid plastic identification signs.

B. Control Valve Tags: baked porcelain enameled steel (low carbon steel)

C. Valve Tag Fasteners: Use corrosion-resistant wire or chain with "S" hooks to secure valve tags.

D. Chart Frames: Provide one (1) aluminum 8 ½” x 11” valve chart frame with glass lens for each valve schedule provided.

E. Access Panel Markers: Provide manufacturer’s standard 1/16” thick engraved plastic access panel markers with abbreviations and numbers corresponding to the concealed valve.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Where identification is to be applied to surfaces requiring painting, insulation, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. The installer shall permanently and clearly label all valves and fire protection piping (i.e. standpipe distribution piping), that its purpose is not obvious. Identification for control valves shall identify the area which is controlled. Contractor shall label all drains for their purpose and label the location of drain outlet at the test valve for ease of test and maintenance.

3.02 UNDERGROUND PIPE IDENTIFICATION

A. During backfilling of each exterior underground piping system, install continuous underground plastic line markers directly over buried line at 6” to 8” below finished grade. Where multiple small lines are buried in a common trench and do not exceed and overall with of 16” install a single line marker.

3.03 VALVE IDENTIFICATION

A. Provide a valve tag on every control device in each piping system. Exclude check valves, valves within factory fabricated equipment units. List each tagged valve in a valve schedule for each piping system.

3.04 EQUIPMENT IDENTIFICATION

A. Install engraved plastic signs or equipment markers on or near each major item of mechanical equipment and each operational device, per the equipment schedule. Attached tag to the ceiling grid directly under equipment installed above lay-in ceilings. Provide markers for the following general categories of equipment and operational devices.
   1. Main control and operating valves including safety devices and hazardous units.
   2. Meters, gauges, and similar units.
   3. Zone valves.
   4. Inspector's Test valves.
   5. Drain valves.

B. Method of installation: Use stainless steel screws except where adhesive is necessary because substrate cannot or should not be penetrated. Use rivets for tags attached to the ceiling grid.

END OF SECTION

SECTION 21 10 00

PIPE, FITTINGS AND ACCESSORIES – FIRE SUPPRESSION

PART 1 GENERAL

1.01 DESCRIPTION

A. Piping specified in this Section is for types of pipe and accessories used in Division 21.

1.02 RELATED SECTION

A. Section 21 05 00 Common Work Results for Fire Suppression.

1.03 QUALITY ASSURANCE

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications govern.

B. Pressure/temperature ratings of all components and accessories shall meet or exceed design conditions for the system in which they are installed.

C. Welding shall be in accordance with procedures of the National Certified Pipe Welding Bureau and shall comply with the requirements of the ANSI Code for Pressure Piping. Welders shall be qualified under the above procedures and certified by the National Certified Pipe Welding Bureau.

D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Steel Piping:

1. Normally wet pipe smaller than 1-1/4" and ALL normally-dry pipe:

Material	Specification
Schedule 40 Black steel	ASTM A135 Grade B

2. Pipe (1-1/4" up to 12” diameter):

Material	Specification
Schedule 10 Black steel	ASTM A53-97b Grade B
Schedule 80 Black steel	ASTM A106-99
Schedule 40 Galvanized steel	ASTM A53-97b

3. Fittings:
   a. 150 lb. SWP malleable iron screwed fittings conforming to ANSI B16.3.
   b. 125 lb. SWP cast iron flange fittings conforming to ANSI B16.1.
   c. Standard weight factory fabricated butt welding fittings conforming to ANSI B16.9 and ASTM A-234.
   d. 150 lb. forged steel welding neck or flat face slip-on flanges conforming to ASTM A181.
   e. Socket fittings conforming to ANSI B16.11.
   f. Cast iron drainage pattern fittings conforming to ANSI B16.12.
   g. Dielectric couplings and/or flange kits shall be provided at connections between ferrous and non-ferrous pipe.
   h. Unions:
      (1) Except where otherwise specified, unions in welded piping shall be flanges.
      (2) Unions in piping 2-inch and smaller shall be 150 lb. malleable iron, ground joint, bronze to iron, screw type.
      (3) Unions in screwed piping 2½" and larger shall be 125 lb. cast iron flanges.
   i. Fittings, flanges and unions in galvanized steel pipe shall be galvanized.
4. Joints, unless specified otherwise:

a. Screwed Joints: Joint compound shall be "Tite-Seal" or Teflon tape, except where otherwise specified.
b. Welded Joints: Welding rods shall be compatible with the material to be welded. Welding shall be by electric arc or oxyacetylene methods.
c. Flanged joints shall be made up with 1/16" thick, ring type, compressed composition sheet gasket, except for gas piping which shall be made up with aluminum "O" ring type gaskets. Flange bolts shall be steel hexagon head type, conforming to ASTM Specification A-307. Nuts shall conform to ASTM Specification A-193.

B. Ductile Iron Pipe:
1. Pipe: AWWA C151, with bituminous outer coating, Class 51 for 4” size and under; Class 50 for 6” and larger. Drainage pipe and fittings to have bituminous inner coating and water service pipe to have cement lining.
2. Fittings: 250 lb. rated ductile iron with mechanical joints and bituminous outer coating, AWWA C110 for water. Service weight coated pipe for soil or rain water piping.

C. Victaulic Pipe
1. Steel Pipe (up to 12” diameter):

Material	Specification
Schedule 40 Black steel	ASTM A53-97b Grade B

2. Steel Pipe (12” and larger diameter):

Material	Specification
Standard weight Black steel	ASTM A53-97b Grade B

3. Steel Fittings:
a. Ductile iron fittings, conforming to ASTM A-536; forged steel, conforming to ASTM A-234; or fabricated from carbon steel pipe, conforming to ASTM A-53 with grooved ends in accordance with AWWA C606.
b. Couplings for use with grooved end fittings shall consist of ductile iron housings, conforming to ASTM A-536, complete with pressure responsive synthetic rubber gasket. (Grade to suit the intended service.)
(1) Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9.
(2) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings shall be placed in close proximity to the vibration source.
(3) Dielectric waterways shall be provided at connections between ferrous and non-ferrous pipe. Dielectric waterways shall consist of ductile iron or carbon steel body, zinc electroplated, with LTHS high temperature stabilized polyolefin polymer liner.
(4) Where grooved joint piping systems are utilized, unions are not required. Couplings shall serve as unions.

2.02 SLEEVES

A. Provide standard weight steel pipe sleeves at all points where piping passes through walls, floors and ceilings, except where otherwise specified.

B. #20 U.S. gauge galvanized steel sleeves may be used through all walls and through floors in concealed pipe chases where concrete thickness is 4" or less.

PART 3 EXECUTION

3.01 PIPING - GENERAL

A. All piping shall be run straight and parallel to building construction. All changes in directions shall be made with fittings as specified herein and shown on the drawings.

B. All piping shall be installed with allowance for expansion and contraction. Anchors and guides shall be provided where shown on the drawings. Swing joints shall be provided at top and bottom and risers and in branch connection at each floor.

C. Pipe connections to equipment which is supported independent of the pipe, including pumps, shall be aligned with the equipment.

D. Buried piping outside the building shall be buried a minimum of 24-inches deep.

E. Install piping so as to preserve access to all valves, air vents, and other equipment and to provide the maximum headroom possible.

F. All piping, except cast iron, which runs through concrete slabs or walls shall be insulated or caulked in sleeves as hereinafter specified so that the pipe metal does not come in contact with the concrete masonry.

G. Equipment Drains, Drips, Etc.:
   1. All devices and equipment having drain, drip or blowdown connection shall be piped to nearest floor drain terminating with an elbow over grate, except where otherwise specified.
   2. Piping shall be run parallel and plumb to walls and shall be braced to walls, floor, other piping or equipment.
   3. Piping shall be full size of device or equipment connection. Except for relief valve discharges, horizontal drains may be combined into one pipe that is one pipe larger than largest connecting pipe.

H. Unions shall be provided at all connections to flow control valves, equipment and apparatus.

3.02 PROCEDURES FOR PIPE JOINTS

A. Welded Joints:
   1. All welding of pipe shall conform to the ASME and ANSI Standards B31.1 Power Piping and B31.9 Building Services Piping.
   2. Mitering or notching pipe to form elbows and tees will not be permitted. Field and shop bevels shall be in accordance with the recognized standards and shall be done by mechanical means or flame cutting. Where beveling is done by flame cutting, surfaces shall be cleaned of slag, scale and oxidation prior to welding.
   3. Before welding, the component parts to be welded shall be aligned so no strain is placed on the weld when finally positioned. Height shall be aligned so that no part of the pipe wall is offset by more than 20 percent of the wall thickness. Flanges and branches shall be set true. This alignment shall be preserved during the welding operations. Connections larger than 6" shall be made with backing rings at welds.
   4. Where the temperature of the component parts being welded reaches 32°F or lower, the material shall be heated to approximately 100°F for a distance of 3' on each side of the weld before welding, and the weld shall be finished before the material cools to 32°F. All welds shall be full penetration welds.
   5. Defective welds shall be removed and replaced at no additional cost to the Owner. Repairing of defective welds by adding new materials over the defects or by peening will not be permitted.
   6. Electrodes shall be stored in a dry, heated area and shall be kept free of moisture or dampness during fabrication operations. Electrodes that have lost part of their flux shall be discarded.
   7. Fire protection safeguards shall be employed in connection with welding operations.
   8. No welding will be permitted where communication equipment has been installed.
   9. Before any welder shall perform any pipe welding, submit a copy of the Welding Operator Qualification Test as required by the referenced standards cited hereinbefore.

B. Screwed Joints:
   1. All threads shall be standard, clean cut and tapered. All burrs shall be reamed from inside of the pipe and pipe shall be turned on end and all loose dirt and scale knocked out.
   2. Pipes with threads stripped, chipped or damaged, or split pipe or defective fittings shall not be used.
   3. Joint compound shall be applied to the male threads only.

C. Flanged Joints: Gaskets shall extend to inside the bolt holes, and flanges shall be brought up truly and water and air tight on gaskets by tightening bolts on opposite sides of the pipe.

D. Ductile Iron Pipe Joints:
   1. Compression joints shall consist of one piece elastomer gasket conforming to ASTM C-564.
   2. Hubless and Gasketed Joints shall be made up in strict accordance with manufacturer's recommendations.

E. Victaulic Joints:
   1. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
   2. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
   3. Assemble piping system per manufacturer’s recommendations.
   4. Cut grooves are not acceptable, unless otherwise specified (i.e. for dry pipe system).

3.03 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.
   1. Sleeves through outside walls above grade shall be caulked watertight between pipe or pipe insulation and sleeve with lead and oakum.
   2. Pipes penetrating walls below grade shall be sealed with a waterproof, modular, mechanical expansion seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Sizing of links and wall sleeve shall be determined by manufacturer. GPT "Link-Seal" or Metraflex “MetraSeal”.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. SLEEVE-SEAL SYSTEMS
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advance Products & Systems, Inc.
      b. CALPICO, Inc.
      c. Metraflex Company (The).
      d. Pipeline Seal and Insulator, Inc.
      e. Proco Products, Inc.
   2. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
      a. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
      b. Pressure Plates: Carbon steel.
      c. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

G. GROUT
   1. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
   2. Characteristics: Nonshrink; recommended for interior and exterior applications.
   3. Design Mix: 5000-psi, 28-day compressive strength.

4. Packaging: Premixed and factory packaged.

H. SLEEVE INSTALLATION
1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   a. Exceptions:
      (1) Sleeves are not required in gypsum board partitions/walls.
      (2) Omit sleeves where fire protection pipes pass through masonry partitions and slabs, provided ALL of the following conditions are met:
         i. cored holes (no jagged edges)
         ii. a pipe hanger or support within 24” of penetration
         iii. pipe is centered in the cored hole
2. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   a. Sleeves are not required for core-drilled holes.
3. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   a. Cut sleeves to length for mounting flush with both surfaces.
      (1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   b. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
4. Install sleeves for pipes passing through interior partitions.
   a. Cut sleeves to length for mounting flush with both surfaces.
   b. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   c. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 21 05 00 " Common Work Results for Fire Suppression”.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 21 05 00 "Firestop Sealant."
6. Sleeves through poured concrete shall be secured to the forms before concrete is poured.
7. Sleeves shall be spaced sufficient distance from adjacent walls and other sleeves so that insulation and/or finish plates may be installed without cutting insulation or plates.
8. Sleeves shall be placed on the piping as it is installed to permit installation of sleeves in walls, partitions, and slabs in one piece.

3.04 PRESSURE TESTING

A. See particular piping section for pressure testing requirements.

END OF SECTION

SECTION 22 00 10
GENERAL PROVISIONS – PLUMBING

PART 1 GENERAL

1.01 DESCRIPTION

A. These Plumbing General provisions specified herein apply to all Sections of Division 22.

1.02 WORK INCLUDED

A. Provide all materials, labor and services as specified in Division 22 and shown on the accompanying drawings.

1.03 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Conditions, and are applicable to all Plumbing Sections.
   1. Provide: Furnish, install and connect completely.
   2. Piping: Pipe installed with all required fittings, valves and accessories, and forming a complete system.
   3. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, and accessories completely installed.
   4. Power Wiring: Wiring that supplies the electrical current that flows through a connected motor or heater.
   5. Exposed: Revealed to view or subject to weather.
   6. Control, interlock and starting circuit wiring: All wiring required by all Plumbing Sections that is not power wiring.
   7. Fittings: All connecting pieces of a system.

B. Drawings: The Mechanical Drawings are diagrammatic except where otherwise specifically indicated. Refer to Architectural and Structural Drawings for building dimensions.

C. Materials: Refer to the General Conditions. All material shall be suitable for the service and operating conditions of this Specification.

1.04 ABBREVIATIONS

A. The following abbreviations are used in this Division of the Specifications:

AGA	American Gas Association
AHRI	Air Conditioning, Heating, and Refrigeration Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitation Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CDA	Copper Development Association
CISPI	Cast Iron Soil Pipe Institute
FM	Factory Mutual
LEED	Leadership in Energy and Environmental Design
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
NRCS	Natural Resources Conservation Service
PDI	Plumbing and Drainage Institute
UL	Underwriters Laboratories
USGBC	United States Green Building Council

1.05 APPLICABLE CODES

A. The latest amended editions of the codes applicable to the work of the municipality having jurisdiction.

B. In the absence of any municipal adopted codes, the following shall apply:
   1. International Building Code, 2012 Edition, with Georgia Amendments (2014) (2015) (2017) (2018)
   2. International Fire Code, 2012 Edition, with Georgia Amendments (2014)
   3. International Plumbing Code, 2012 Edition, with Georgia Amendments (2014, 2015)
   4. International Mechanical Code, 2012 Edition, with Georgia Amendments (2014, 2015)
   5. International Fuel Gas Code, 2012 Edition, with Georgia Amendments (2014, 2015)
   6. National Electrical Code, 2017 Edition (No Georgia Amendments)
   7. International Energy Conservation Code, 2009 Edition, with Georgia Supplements and Amendments (2011, 2012)
   8. All City, County, State, Regional, and other ordinances applicable to the work shall apply.
   1. Chapter 120-3-20: Georgia Accessibility Code for Buildings and Facilities.
   2. Chapter 120-3-3: Georgia Rules and Regulations for the State Minimum Fire Safety Standards.
   3. Chapter 120-3-11: Georgia Rules and Regulations for Flammable and Combustible Liquids.

1.06 QUALITY ASSURANCE

A. This work requires special construction expertise that must be verified through documented experience. Therefore, any major Sub-Contractor submitting a bid for this scope of work must confirm that he has completed similar work. The following requirements for Work Experience and Contracting Experience and Licensing shall be documented and submitted with other required forms.
   1. Demonstrated experience in completing installations of at least three (3) similar projects and a minimum of five (5) years experience involving renovation, additions and new work of domestic water, sanitary, waste and vent piping systems and natural gas piping systems.
   2. Contracting Experience and Licensing:
      a. The Contractor shall have been in business under the present company name for a minimum of five (5) years, shall have a State of Georgia, Master Plumber Class II license. An officer, partner or principal of the Contractor shall be the holder of the License.
      b. The Contractor shall not have been declared in default on any construction contract within that time.

B. Experience outlined in paragraphs above must be demonstrated by projects which are complete prior to the bid date for this work.

C. Bids will not be accepted from Contractors failing to meet the qualifications established or from Contractors failing to submit the required documentation of qualifications.

1.07 SPACE CONDITIONS

A. All work shall fit the spaces available. Verify all dimensions of the work before commencing fabrication and/or installation.

B. Minor deviations from the drawings required to conform to space conditions and to provide the required operation, service, or maintenance accessibility shall be made at no additional cost, and subject to approval.

C. Piping and equipment shall not be installed in electrical equipment rooms. Outside of electrical equipment rooms, do not run piping or locate equipment, with respect to switchboards, panel boards, power panels, motor control centers or dry type transformers:
   1. Within 42" in front (and rear if free standing) of equipment; or
   2. Within 36" of sides of equipment
   3. Clearances apply vertically from floor to ceiling structures.

D. Hydronic piping shall not be installed above any electrical or control panels.

1.08 RECORD DRAWINGS

A. Upon completion of the Project, the Contractor shall submit one set of contract prints with red marks indicating As-built conditions of all piping and equipment, and incorporating changes made during construction. A record of as-built conditions shall be kept throughout the Project and shall be used in the preparation of the final record drawings.

B. The Contractor shall provide digital images (minimum resolution of 1152 x 864 pixels in JPEG standard image file format) delivered via email, thumb drive, or on CD, of any utilities/piping that are installed underground with a reference drawing indicating which direction each picture is taken. The reference drawing shall dimension the utility/piping from a prominent fixed object.

1.09 WARRANTIES AND GUARANTEES

A. The materials of the plumbing systems shall have the Manufacturer's and/or supplier's Guarantee or Warranty put into effect by execution and filing of any and all related papers. Minimum warranty shall be for one (1) year from date of substantial completion. Date of substantial completion shall be determined by the Owner. If the manufacturer's standard warranty is for a longer period, it shall apply. Obtain service or repair under the terms of and said Guarantee or Warranty in behalf of the Owner.

B. The installed plumbing systems shall be delivered to the Owner in proper working order. Contractor shall warranty the plumbing system for a period of one (1) year, replace any work or material, which develops defects, excluding normal wear and tear, from the date of substantial completion.

C. Warranties and Guarantees shall be furnished in exact conformity with the requirements of the General Conditions.

1.10 BUILDING UTILITIES

A. Arrange with appropriate utility agencies for the connection of all utility services and pay all charges in connection therewith.

B. Domestic water service shall connect to the water main as indicated on the civil drawings.

C. The water meter shall be of the size shown on the civil drawings.

D. The gas meter shall be of the capacity and pressure range shown on the drawings. Gas meter and piping upstream of the meter shall be provided by the local utility company.

E. The building sewer shall connect into the public sanitary sewer, as shown on the civil drawings.

F. Building rainwater piping shall terminate exterior to the building, as indicated on the civil drawings.

G. Where boring under city streets or state highways is required for connection to utilities, contractor shall confirm and follow requirements as outlined by authority responsible for utility systems. All costs for boring shall be paid by the contractor.

1.11 CONTINUITY OF SERVICE

A. All work shall be scheduled with that of other trades. The following conditions shall apply to all affected work.

B. Before disconnecting any existing systems for changes, the Contractor shall:
   1. Have all needed materials stored at the job site.
   2. Have assurance that all labor and skilled mechanics needed will be available at the proper time.
   3. Estimate the time the system will be out of service and inform the Owner in writing.
   4. Secure approval of the shutdown dates from the Owner in writing before disconnecting the system.

C. Work shall be so conducted that the water and gas supply and drainage of existing services will not be interrupted when such services are required for normal usage of the occupied portions of the existing building.

D. Work shall be done at such time and in such manner as to cause minimum inconvenience to the Owner and as approved by him or his representative. No allowance will be made for lack of knowledge of existing conditions.

1.12 OPERATING INSTRUCTIONS

A. Instructions: Instruct the Owner's representative in operation of the installed systems. The basis of these instructions shall be those written for inclusion in the maintenance and operating instruction data specified herein. Obtain certificates, signed by the Owner's representative, that these instructions have been received.

B. Notification: Notify the Owner at least five days before commencing operating period for domestic heating equipment, as specified herein, in order that the Owner's representative may be present during that period.

1.13 DOCUMENTATION

A. Documents to be submitted prior to request for final inspection:
   1. Maintenance Manuals per Section 22 0100.
   2. Three copies of multi-year warranties and guarantees bound in a brochure with index listing equipment.

B. Data to be Delivered at Final Inspection:
   1. Record Drawings.
   2. Images of underground piping/utilities and related reference drawing.
   3. Certificate by Owner's representative confirming that operating instructions have been received.

1.14 SUBMITTALS

A. Procedure: Refer to the GENERAL CONDITIONS and SUPPLEMENTS thereto for submittal procedure of items called for in the Contract Documents.

B. Submittal data covering the work of this Division will be reviewed only after such items have been reviewed in detail and approved by the Contractor, such approval being indicated by suitable notations or stamp on the data.

C. **Each submittal shall be clearly marked indicating Specification Section and paragraph for which it is intended. Any deviations, exclusions or substitutions from specified material requirements shall be specifically identified in a summary sheet at the front of the submittal.**

D. **Where submittal sheets contain multiple products or selections, the specific item being submitted for review shall be clearly indicated with a red arrow (stamped or hand written). “Catalog” submittals (multiple items contained in the submittal, specific items not identified) will be rejected and not reviewed.**

E. Submit the requested submittals in sufficient quantity to provide two copies in addition to those required by Contractor.

F. All pump submittals shall include performance curves indicating flow, pressure, efficiency, and power requirements. For pumps, adjacent impeller selections shall be included.

G. Motor Tabulation on all motors furnished listing the following nameplate data: Horsepower, voltage, phase and full load amps.

H. Submittal List: See the individual Plumbing Specification Sections for specific submittal requirements.

END OF SECTION 22 0010

SECTION 22 01 00

OPERATION AND MAINTENANCE OF PLUMBING

PART 1 GENERAL

1.01 MAINTENANCE AND OPERATING MANUALS

A. Provide manual in number of copies indicated under Section 22 0010 – General Provisions - Plumbing.

B. Material submitted in the manuals shall represent the equipment manufacturer, model, and type installed on the project.

PART 2 PRODUCTS

2.01 MAINTENANCE AND OPERATING MANUALS

A. Maintenance and Operating Manuals shall consist of the following as a minimum:
   1. Hardback three ring binders with job name and Owner's name on cover.
   2. Typed index listing name, address, and phone number of the General Contractor, Plumbing Subcontractor, Insulation Subcontractor, and all major equipment suppliers.
   3. Typed table of contents, listing each section, title, and number.
   4. All Sections shall be tabbed with plastic tabs listing Section numbers.
   5. Each item of equipment requiring maintenance and operation data as noted in each specification section shall be provided with an index listing the types of equipment installed. Submittal data shall be included to the extent necessary to identify equipment, including summary sheet, such as model, size, water flow, pressure developed, speed, and motor size. Instructions shall include type and suggested frequency of maintenance, oiling, cleaning, disassembly, and reassembly directions, and wiring diagrams.
   6. One section shall include a complete set of record control drawings, bound in a plastic insert, full size, complete with a written sequence of operation for all control systems.
   7. Letters, where factory startup or checking has been required, certifying completion of performance.

PART 3 EXECUTION

3.01 MAINTENANCE AND OPERATING MANUALS

A. All maintenance and operating manuals shall be complete and ready to turn over to Owner's representative at final inspection.

B. Incomplete manuals will be returned to the Contractor for complete resubmission. Loose leaf submittal of material at various stages of completion will not be acceptable.

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section of specifications deals with materials and methods pertaining to all work specified under Division 22.

1.02 RELATED SECTIONS

A. Section 22 00 10 General Provisions Plumbing

B. Section 22 05 23 Plumbing Valves and Strainers

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide submittal data showing starter dimensions, weight, electrical requirements, and service access requirements.

C. Provide submittal data showing motor horsepower, electrical requirements, and efficiency.

D. Provide submittal data showing firestop systems, including details for penetrations and instructions for installation

E. Provide manufacturer's instructions, indicate installation and support requirements.

1.04 JOB CONDITIONS

A. Install all apparatus so as to maintain maximum headroom and clearances consistent with requirements of the drawings and specifications.

B. All equipment requiring service shall be installed to permit access for servicing without damage to building structure or finishes.

PART 2 PRODUCTS

2.01 SUPPORTS AND HANGERS

A. Individual horizontal piping shall be supported as follows:
   1. Steel and cast iron piping with painted clevis hangers.
   2. Hangers in contact with copper piping shall be copper plated swivel ring type.
   3. Hangers around insulated copper piping shall be painted clevis or galvanized steel swivel ring type.
   4. Copper piping exposed adjacent to structure shall be secured with copper plated pipe clamp.
   5. All attachments in contact with copper piping shall be copper, copper plated or plastic coated.
   6. Horizontal, parallel and adjacent piping shall be supported by gang hangers utilizing PVC coated channel and PVC coated standard pipe clamps or approved equal.
   7. Hangers for PVC water piping shall be galvanized steel swivel ring type.

B. Concealed vertical piping shall be supported as follows:
   1. Steel and cast iron piping with painted riser clamps.
   2. Copper piping with copper plated riser clamps.

C. Exposed Vertical Piping shall be supported by attachment to wall at midpoint with offset pipe clamps. Clamp for uninsulated copper piping shall be copper plated or plastic coated.

D. Pipe in Chases:
   1. Piping in pipe chases shall be secured to building structure using attachments hereinbefore specified. Hangers for water piping within plumbing chases shall be supported with rods bolted to pipe clamps which shall be affixed to cast iron pipe. Piping may be supported from the more rigid cast iron pipe with the use of plastic brackets designed for that purpose.

2. Rough-in stubs through partitions to fixtures (in particular to flush valves and shower heads) shall be securely anchored by means of an attachment secured to wall or cast iron pipe.

E. Hangers and pipe attachments for sprinkler systems and standpipes shall meet the requirements of NFPA 13 and NFPA 14 respectively.

F. Hangers and pipe attachments, except where otherwise specified shall be Elcen , Hilti, Michigan Hanger Company, B-Line, or Grinnell.

2.02 STRUCTURAL ATTACHMENTS

A. Inserts:
1. Individual inserts shall be malleable iron type selected for the type and thickness of the slab and the load to be carried.
2. Continuous inserts shall be formed galvanized steel type selected for the type and thickness of the slab and the load to be carried. Inserts shall be furnished with end caps, closure strips and shall be anchored at 6" O.C.
3. Inserts shall be used in poured in place concrete slabs.
4. Inserts shall be Elcen, Michigan Hanger, Grinnell, or B-Line.

B. Concrete Fasteners:
1. Fasteners shall be self-drilling type, Locke Mfg. Co. "Bull Dog", Phillips "Red Head", or Diamond "Blue-Cut".
2. Fasteners shall be used in solid masonry walls and shall be used in solid concrete walls.

C. Toggle Bolts with not less than 1/4" diameter bolts shall be used in hollow type wall construction.

D. Clamps of configuration compatible with beams and steel members shall be used in steel construction. Clamps shall be Grinnell, Michigan Hanger Company, Elcen, or B-Line.

E. Hanger rods shall be selected to safely carry the load to be supported and shall not be less than the diameter listed by the hanger manufacturers for the specific size hanger used.

2.03 FIRESTOP SEALANT

A. Firestop sealant shall be a synthetic elastomer caulk, strip, or sheet designed for use as a one part fire, smoke, and gas sealant. Material shall be intumescent and capable of being installed with caulk gun, shears, and putty knife. Material shall be UL classified and Factory Mutual approved for sealing in floors, walls, or partitions to 3 hour rating per ASTM E-814.

B. Fire barrier material shall be 3M Fire Barrier Sheet, Strip, and Caulk.

2.04 ASBESTOS

A. All materials used in this work shall be asbestos free.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be installed plumb and square unless clearly indicated otherwise. Installation shall be performed by competent persons, trained in their respective skills.

B. Furnish and install equipment complete, including connections, services and adjustments for systems to operate safely and in compliance with requirements of the contract.

C. Install each item in full compliance with current recommendations of the manufacturer. Equipment manufacturer or his authorized representative shall furnish services and/or supervision necessary to ensure compliance with this provision. Conflict between manufacturer's recommendation and other contract requirements shall be resolved before installation.

D. Requirements of the several acceptable manufacturers for each specified item of equipment may vary as to installation details, location and number of connections, dimensions and weight. Provide all drawings, services, material, and labor necessary for the installation and proper functioning of the equipment furnished.

3.02 PROTECTION OF MATERIALS AND EQUIPMENT

A. Take precautions to protect all materials and equipment from damage during the construction process.

B. Do not store materials and equipment outdoors subject to weather without complete weather protection.

C. Do not install materials or equipment in a partially constructed structure exposed to weather, unless all material and equipment is continuously protected from damage by weather or the construction process.

D. Material and equipment damaged by improper protection during construction is subject to replacement based on the judgment of the Engineer at no cost to the Owner.

3.03 CUTTING AND REPAIRING

A. Cut and repair all walls, floors, and ceilings necessary for the installation of the mechanical work, but no cutting of work of other trades will be permitted without the consent of the Architect or his representative.

B. All cutting and repairing of walls, floors, and ceilings shall be subject to the supervision and approval of the Contractor.

3.04 CLEANING AND FINAL CLEAN-UP

A. Keep the premises free of waste, debris and surplus materials.

B. After equipment has been installed, remove all extraneous materials, rust and stains; blow, vacuum or flush all foreign matter from all equipment.

C. Identification plates on equipment shall be free of paint and shall be polished.

3.05 EXCAVATION AND BACKFILL

A. Do all trenching, excavating and backfilling required for the Mechanical Sections. Include all necessary repairing, shoring, bracing, pumping and protection for safety of persons and property. Repairing shall be comparable to work cut and shall be approved by the proper authorities.

B. Slope sides of excavations to comply with OSHA regulations and local ordinances having jurisdiction. Shore and brace where sloping is not possible either because space restrictions or stability of materials excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

C. Care shall be taken to avoid existing facilities in excavating. Contractor shall be responsible for all damage to existing facilities in executing this work.

D. Excavate rock to depth of 6" below bottom of pipe. Space between rock and pipe shall be filled with sand.

E. Bottom of trenches shall be graded to secure the required fall. Size of bell holes for soil and sewer pipe shall be held to a minimum so that the entire pipe length rests on compacted fill or undisturbed earth.

F. Backfill shall be placed completely under pipe haunches and in bell holes and uniformly tamped in 6" layers. Backfill over top of pipe with select materials free of clods, stones, boulders, and foreign materials. Back fill shall not be installed until pipe is insulated, tested and field inspected by inspector.

G. Backfill shall be compacted to 95% of maximum dry density as determined by a Standard Proctor Test, ASTM-D698, except where under areas to be paved, top 12 to 24 inches of fill shall be compacted to 97% dry density by above standard.

3.06 PIPING SUPPORTS AND ANCHORS

A. Waste, drain, and relief valve discharge piping shall be securely anchored to structure, equipment or concrete base. Piping shall be located with two inches clear above the floor.

B. Combination riser clamps may be used where more than one pipe passes through floors.

C. Riser clamps for support of risers shall span penetration of slot or sleeve in floor. In exposed location, use short span clamps.

D. Hang all piping so that equipment flanges and connections bear none of weight of piping. At pump suction and discharges, piping shall be supported free of pump casing through the use of base elbows.

E. Horizontal supports shall be spaced as follows:
   1. Steel piping at not more than 10' intervals.
   2. Cast iron piping at 5' intervals, except supports shall be placed at intervals equal to the pipe length but not to exceed 10'. Also, no hub pipe over 3" size shall be supported at each change from horizontal to vertical or vertical to horizontal direction.
   3. Copper piping 1-inch and smaller at 8' intervals; larger than 1-inch at 10' intervals.
   4. PVC piping at not more than 4’ intervals.

F. Vertical supports shall be spaced as follows:
   1. Steel piping at every other story height.
   2. Copper piping larger than 1-inch at every other story height; 1-inch and smaller at every story height.
   3. Cast iron, piping at every story height. Cast iron pipe stacks shall be supported with concrete piers at the base of stacks over two stories.
   4. In addition, no-hub cast iron and gasketed cast iron piping shall be supported and/or guided at midpoint of each story height.

G. Sprinkler piping and standpipe shall be supported and anchored as required by NFPA 13, 1996, and NFPA 14, 1996 respectively.

3.07 HANGER SIZES

A. Hangers shall be sized to fit the pipe except for the insulated piping, in which case hangers shall be of size for pipe and insulation to pass through.

B. See Insulation for Pipe Saddles.

3.08 STRUCTURAL ATTACHMENTS

A. Inserts shall be used for individual loads exceeding 150 lbs. Concrete fasteners may be used where approved in writing by Architect for individual loads of 150 lbs. or less.

B. Inserts shall be secured to the forms before the pouring of concrete. In all spaces with exposed concrete ceilings, the openings not filled with rods and nut shall be filled with cement grout flush with the ceiling.

C. Shooting of fasteners into the slab shall be allowed only in approved locations.

D. Devices for connection to the structure shall not be loaded more than 75% of the manufacturer's rated load.

3.09 FIRESTOP SEALING FLOOR AND WALL PENETRATIONS

A. Where piping, control tubing, and conduit penetrate fire or smoke rated walls and floors, the penetration shall be sealed with fire barrier herein specified.

B. Fire barrier shall be installed in strict accordance with manufacturer's printed instructions. Material shall be installed with sufficient depth to maintain a fire endurance rating equivalent to that of the adjacent wall or floor.

END OF SECTION

SECTION 22 05 23
PLUMBING VALVES AND STRAINERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the valves and strainers common to the plumbing piping systems of Division 22. HVAC, fire protection, and other specialty valves and accessories are specified in other Sections of Division 22.

1.02 RELATED SECTIONS

A. Section 22 05 00 Common Work Results for Plumbing

B. Section 22 10 00 Pipe, Fittings and Accessories – Plumbing

C. Section 22 10 05 Plumbing, Piping and Drainage Accessories

1.03 QUALITY ASSURANCE

A. All gate, globe and check valves provided under Plumbing Sections shall be of the same manufacturer, except as otherwise specified.

B. All other valves of a given type shall be by the same manufacturer.

C. All valves shall have asbestos-free packing and gaskets.

D. All valves and fittings shall be of Lead Free construction. Lead Free refers to less than 0.25% weighted average lead content in relation to wetted surface of pipe, fittings and fixtures in systems delivering water for human consumption. Any product designed for dispensing potable water shall meet both the NSF/ANSI 61 and NSF/ANSI 372 test standards via third party testing and certification.

1.04 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide Individual data sheets with complete system information including mechanical components.

C. Provide manufacturer’s instructions, indicate any installation and support requirements.

D. Provide operation and maintenance procedures; assembly drawings and parts list.

PART 2 PRODUCTS

2.01 GAS VALVES

A. Gas valves shall be lubricated plug type meeting requirements of ANSI/ASME B16.33 with semi steel body and removable handle rated for 125 psig. Valves shall be threaded in size 2" and under and flanged over 2" size.

2.02 GAS PRESSURE REGULATORS

A. Pressure regulators shall be spring loaded adjustable regulator with cast iron body, brass orifice, Buna-N or silicone valve seat, steel valve stem with inlet and outlet rated for pressure and capacity noted on the plans. Regulators shall maintain a reduced outlet pressure under lockup (no-flow) conditions. Regulators installed on the exterior of the building shall be approved for outdoor installation. Regulators installed on the interiro of the building shall be approved for indoor installation without vent connection.

PART 3 EXECUTION

3.01 VALVE INSTALLATION

A. Install valves in accessible locations with stems located in horizontal or vertical positions. Gate and globe valves shall be installed with the valve stem pointing upward.

B. Install a gas valve and union at each piece of equipment.

C. Gas pressure regulators shall comply with the following:
   1. Pressure regulators shall be provided with access and protected from physical damage.

2. Where located indoors, the regulator shall be vented to the outdoors or shall be equipped with a leak limiting device. Pressure regulators that require a vent shall have an independent vent to the outside of the building. The vent shall be designed to prevent the entry of water or foreign objects.
3. A tee fitting with one opening capped or plugged shall be installed between the regulator and its upstream shutoff valve. The tee fitting shall be positioned to allow connection of a pressure measuring instrument and to serve as a sediment trap.
4. A tee fitting with one opening capped or plugged shall be installed not less than 10 pipe diameters downstream of the pressure regulator outlet. The tee fitting shall be positioned to allow connection of a pressure measuring instrument.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the identification requirements for the plumbing systems.

1.02 RELATED SECTIONS

A. Section 22 00 10 General Provisions Plumbing

B. Section 22 05 00 Common Work Results for Plumbing

C. Section 22 10 05 Plumbing Piping and Drainage Accessories

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

C. Schedules: Submit valve schedule for each piping system, typewritten and produced on 8½" x 11" bond paper. Include valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and any variations for identification. If addition to framed copies, furnish extra copies for maintenance manuals as specified in Division 1.

1.04 SUMMARY

A. Section includes:
1. Plastic Coiled Pipe Markers.
2. Pressure Sensitive Adhesive Pipe Markers.
3. Underground Warning Tape.
4. Valve Tags and Schedules.
5. Engraved Plastic Signs.
6. Engraved Equipment Markers.
7. Plastic Tags.

1.05 REFERENCES

A. American National Standards Institute (ANSI): ANSI A13.1-1985 – Scheme for the Identification of Piping Systems.

B. Department of Labor 29 CFR 1910.1200.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification products of types and sizes required, whose products have been in satisfactory use for a period of five (5) years.

B. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification products.

PART 2 PRODUCTS

2.01 MECHANICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products for each application as referenced in this section.

2.02 PIPE MARKERS

A. Pressure-Sensitive Type: Provide manufacturer's standard preprinted, permanent adhesive, color-coded pressure sensitive vinyl labels complying with ANSI A13.1. Color-coded plastic adhesive flow directional arrow tape, full circle at both ends of the pipe marker, tape overlapped 1-1/2". Use 1" tape for piping less than 2-1/2", 2" tape for 2-1/2" thru 8" piping; and 4" tape for larger piping.

B. Lettering: Comply with ANSI A 13.1 for piping system nomenclature. Abbreviate only as necessary to accommodate marker length.

2.03 UNDERGROUND TYPE PLASTIC LINE MARKERS

A. Metallic Piping: Provide manufacturer's standard non-detectable permanent, continuous printed plastic tape, intended for direct burial service, not less than 3" wide by 4 mils thick. Provide tape with printing most accurately indicating type of service of buried pipe.

B. Non-Metallic Piping: Provide manufacturer's standard detectable, multi-ply tape consisting of solid aluminum foil core between 2 layers of plastic tape, not less than 3" wide by 5 mils thick. Provide tape with printing most accurately indicating type of service of buried pipe.

2.04 VALVE TAGS

A. Plastic Tags: Provide manufacturer's standard 1/16" plastic engraved tags, 1½" square, black with white lettering, with ¼" high service indicator on top line and ½" numbers below.

B. Valve Tag Fasteners: Use solid brass "S" hooks for installation of valve tags.

C. Chart Frames: Provide one (1) aluminum 8 ½" x 11" valve chart frame with glass lens for each valve schedule provided.

D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic access panel markers with abbreviations and numbers corresponding to the concealed valve.

2.05 ENGRAVED PLASTIC EQUIPMENT MARKERS

A. Provide manufacture's standard 1/16" engraved equipment tags matching the terminology on schedules as closely as possible. Use black with white letters, 1" x 3" or 1 ½" x 4" for control devices, and valves and 4" x 6" for equipment. Use green with white letters, 3" long x the ceiling grid width for equipment above lay-in ceilings.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Where identification is to be applied to surfaces requiring painting, insulation, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 MARKER LOCATION

A. Install pipe markers on each system indicated, include arrows showing normal direction of flow.

B. Schedule of Piping Identification:

Piping Systems and Contents	Tape Background Color	Stenciled Legends
Gas Systems		
Gas	Yellow	Natural Gas

C. Locate pipe markers and/or color bands (if required) wherever piping is exposed to view, and at least one marking per room above suspended ceilings. Per the following:
1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units mark each branch where there might be a question of flow direction.
3. Near locations where pipes pass through walls, floors, or ceilings or where they enter non-accessible locations.
4. Behind removable panels and other access points permitting view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. On piping above removable acoustical ceilings.
7. At maximum intervals of 40' along each straight pipe run, except to 25' in congested areas.

D. During backfilling of each exterior underground piping system, install continuous underground plastic line markers directly over buried line at 6” to 8” below finished grade. Where multiple small lines are buried in a common trench and do not exceed and overall with of 16” install a single line marker.

3.03 VALVE IDENTIFICATION

A. Provide a valve tag on every, cock, and control device in each piping system. Exclude check valves, valves within factory fabricated equipment units, plumbing fixture faucets, convenience and lawn watering hose bibs, shut-off valves at plumbing fixtures. List each tagged valve in a valve schedule for each piping system.

3.04 EQUIPMENT IDENTIFICATION

A. Install engraved plastic signs or equipment markers on or near each major item of mechanical equipment and each operational device, per the equipment schedule. Attached tag to the ceiling grid directly under equipment installed above lay-in ceilings. Provide markers for the following general categories of equipment and operational devices.
   1. Main control and operating valves including safety devices and hazardous units.
   2. Meters, gauges, thermometers, and similar units.
   3. Fuel burning units including boilers and heaters.
   4. Pumps and similar motor driven units.
   5. Tank and pressure vessels.
   6. Strainers, filters, water treatment systems, and similar equipment.

B. Method of Installation: Use stainless steel screws except where adhesive is necessary because substrate cannot or should not be penetrated. Use rivets for tags attached to the ceiling grid.

END OF SECTION

SECTION 22 10 00

PIPE, FITTINGS AND ACCESSORIES – PLUMBING

PART 1 GENERAL

1.01 DESCRIPTION

A. Piping specified in this Section is for types of pipe and accessories used in Division 22.

1.02 RELATED SECTIONS

A. Section 22 05 00 Common Work Results for Plumbing

B. Section 22 10 05 Plumbing Piping and Drainage Accessories

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide product data for pipe and fitting materials, indicating conformance with specified standards.

1.04 QUALITY ASSURANCE

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications govern.

B. Pressure/temperature ratings of all components and accessories shall meet or exceed design conditions for the system in which they are installed.

C. Welding shall be in accordance with procedures of the National Certified Pipe Welding Bureau and shall comply with the requirements of the ANSI Code for Pressure Piping. Welders shall be qualified under the above procedures and certified by the National Certified Pipe Welding Bureau.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Steel Pipe and Fittings:

1. Pipe (up to 12” diameter):

Material	Specification
Schedule 40 Black steel	ASTM A53, latest edition, Grade B
Schedule 80 Black steel	ASTM A106, latest edition
Schedule 40 Galvanized steel	ASTM A53, latest edition

2. Fittings:
   a. 150 lb. SWP malleable iron screwed fittings conforming to ANSI B16.3.
   b. 125 lb. SWP cast iron flange fittings conforming to ANSI B16.1.
   c. Standard weight factory fabricated butt welding fittings conforming to ANSI B16.9 and ASTM A-234.
   d. 150 lb. forged steel welding neck or flat face slip-on flanges conforming to ASTM A181.
   e. Socket fittings conforming to ANSI B16.11.
   f. Cast iron drainage pattern fittings conforming to ANSI B16.12.
   g. Dielectric couplings and/or flange kits shall be provided at connections between ferrous and non-ferrous pipe. Provide with high temperature gaskets rated for 300°F steam service.
   h. Unions:
      (1) Except where otherwise specified, unions in welded piping shall be flanges.
      (2) Unions in piping 2-inch and smaller shall be 150 lb. malleable iron, ground joint, bronze to iron, screw type.
      (3) Unions in screwed piping 2½" and larger shall be 125 lb. cast iron flanges.
   i. Fittings, flanges, and unions in galvanized steel pipe shall be galvanized.
3. Joints, unless specified otherwise:

a. Screwed Joints: Joint compound shall be "Tite-seal" or Teflon tape, except where otherwise specified.
b. Welded Joints: Welding rods shall be compatible with the material to be welded. Welding shall be by electric arc or oxyacetylene methods.
c. Flanged joints shall be made up with 1/16" thick, ring type, compressed composition sheet gasket, except for gas piping which shall be made up with aluminum "O" ring type gaskets. Flange bolts shall be steel hexagon head type, conforming to ASTM Specification A-307. Nuts shall conform to ASTM Specification A-193.

4. Pipe and fittings shall be made in America unless otherwise approved.

2.02 FLOOR AND CEILING PLATES

A. Provide floor and ceiling plates at each exposed point where pipe passes through walls, floors, and ceilings except in Mechanical Equipment Rooms.

B. Floor Plates:
1. Where pipe sleeve projects above the floor, plates shall be chrome plated cast iron, F&S Fig. 603 or Ritter Fig. 36A.
2. Where pipe sleeve is flush with floor, plates shall be chrome plated cast iron, F&S Fig. 602 or Ritter Fig. 3A.

C. Wall and Ceiling Plates:
1. Wall and ceiling plates shall be chrome plated, stamped steel, hinged type with springs for providing a snug fit around pipe and/or insulation.
2. Plates shall be manufactured by Beaton & Corbin, or Beaton & Cadwell.

2.03 SLEEVES

A. Provide standard weight steel pipe sleeves at all points where piping passes through walls, floors, and ceilings, except where otherwise specified.

B. #20 U.S. gauge galvanized steel sleeves may be used through all walls and through floors in concealed pipe chases where concrete thickness is 4" or less.

PART 3 EXECUTION

3.01 PIPING - GENERAL

A. All piping shall be run straight and parallel to building construction. All changes in directions shall be made with fittings as specified herein and shown on the drawings.

B. All piping shall be installed with allowance for expansion and contraction. Anchors and guides shall be provided where shown on the drawings. Swing joints shall be provided at top and bottom and risers and in branch connection at each floor.

C. Pipe connections to equipment that is supported independent of the pipe, including pumps, shall be aligned with the equipment.

D. Buried piping outside the building shall be buried a minimum of 24-inches deep.

E. Install piping so as to preserve access to all valves, air vents, and other equipment and to provide the maximum headroom possible.

F. All piping, except cast iron, which runs through concrete slabs or walls shall be insulated or caulked in sleeves as hereinafter specified so that the pipe metal does not come in contact with the concrete masonry.

G. Equipment Drains, Drips, Etc.:
1. All devices and equipment having drain, drip or blowdown connection shall be piped to nearest floor drain terminating with an elbow over grate, except where otherwise specified.
2. Piping shall be run parallel and plumb to walls and shall be braced to walls, floor, other piping, or equipment.
3. Piping shall be full size of device or equipment connection. Except for relief valve discharges, horizontal drains may be combined into one pipe that is one pipe larger than largest connecting pipe.

4. Condensate drains shall be trapped and provided with unions and cleanouts.

H. Unions shall be provided at all connections to flow control valves, equipment, and apparatus.

3.02 PROCEDURES FOR JOINTS IN STEEL PIPING

A. Welded Joints:
1. All welding of pipe shall conform to the ASME and ANSI Standards B31.1 Power Piping and B31.9 Building Services Piping.
2. Mitering or notching pipe to form elbows and tees will not be permitted. Field and shop bevels shall be in accordance with the recognized standards and shall be done by mechanical means or flame cutting. Where beveling is done by flame cutting, surfaces shall be cleaned of slag, scale, and oxidation prior to welding.
3. Before welding, the component parts to be welded shall be aligned so no strain is placed on the weld when finally positioned. Height shall be aligned so that no part of the pipe wall is offset by more than 20 percent of the wall thickness. Flanges and branches shall be set true. This alignment shall be preserved during the welding operations. Connections larger than 6" shall be made with backing rings at welds.
4. Where the temperature of the component parts being welded reaches 32°F or lower, the material shall be heated to approximately 100°F for a distance of 3' on each side of the weld before welding, and the weld shall be finished before the material cools to 32°F. All welds shall be full penetration welds.
5. Defective welds shall be removed and replaced at no additional cost to the Owner. Repairing of defective welds by adding new materials over the defects or by peening will not be permitted.
6. Electrodes shall be stored in a dry, heated area and shall be kept free of moisture or dampness during fabrication operations. Electrodes that have lost part of their flux shall be discarded.
7. Fire protection safeguards shall be employed in connection with welding operations.
8. No welding will be permitted where communication equipment has been installed.
9. Before any welder shall perform any pipe welding, submit a copy of the Welding Operator Qualification Test as required by the referenced standards cited hereinbefore.

B. Screwed Joints:
1. All threads shall be standard, clean cut and tapered. All burrs shall be reamed from inside of the pipe, and pipe shall be turned on end and all loose dirt and scale knocked out.
2. Pipes with threads stripped, chipped or damaged, or split pipe or defective fittings shall not be used.
3. Joint compound shall be applied to the male threads only.

C. Flanged Joints: Gaskets shall extend to inside the bolt holes, and flanges shall be brought up truly and water and air tight on gaskets by tightening bolts on opposite sides of the pipe.

3.03 SLEEVES

A. Provide all sleeves in floors, beams, walls, roof, etc., as required for installing work of this Division unless otherwise specified hereinafter.

B. Where exposed in rooms, sleeves in floor slabs, except those on grade, shall project ¼" to 3/8" above finished floor.

C. Sleeves shall be of sufficient size for pipe and full size insulation to pass through.

D. Sleeves through outside walls above grade shall be caulked watertight between pipe or pipe insulation and sleeve with lead and oakum.

E. Pipes penetrating walls below grade shall be sealed with a waterproof, modular, mechanical expansion seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Sizing of links and wall sleeve shall be determined by manufacturer. GPT "Link-Seal" or Metraflex “MetraSeal”.

F. Sleeves through poured concrete shall be secured to the forms before concrete is poured.

G. Piping passing under or through wall footings, foundations, and retaining walls shall be provided with a relieving arc, or an iron pipe sleeve two pipe sizes greater than the pipe passing through.

H. Sleeves shall be spaced sufficient distance from adjacent walls and other sleeves so that insulation and/or finish plates may be installed without cutting insulation or plates.

I. Sleeves shall be placed on the piping as it is installed to permit installation of sleeves in walls, partitions, and slabs in one piece.

J. Omit sleeves where cast iron pipes pass through masonry partitions, slabs on grade, and where all pipes pass through gypsum board partitions.

K. See Section 22 0500 Common Work Results for Plumbing regarding firestop requirements.

3.04 PRESSURE TESTING

A. See particular piping section for pressure testing requirements.

END OF SECTION

SECTION 22 10 05
PLUMBING PIPING AND DRAINAGE ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the types of piping and accessories for the domestic water service and plumbing system.

1.02 RELATED SECTIONS

A. Section 22 00 10 General Provisions - Plumbing

B. Section 22 01 00 Operation and Maintenance of Plumbing

C. Section 22 05 00 Common Work Results for Plumbing

D. Section 22 05 23 Plumbing Valves and Strainers

E. Section 22 05 53 Identification for Plumbing Piping and Equipment

F. Section 22 10 00 Pipe, Fittings and Accessories – General

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide product data for all manufactured assemblies; including component dimensions, pipe connection sizes, and pressure drop vs. flow (if applicable).

C. Provide manufacturer's instructions, indicate installation and support requirements.

D. Provide operation and maintenance data; include start-up instructions, assembly drawings, and parts list.

1.04 QUALITY ASSURANCE

A. All drains shall be by the same manufacturer.

B. Video inspection shall be performed on all major sanitary sewer and rainwater trunk lines from the most upstream cleanout all the way to the first manhole. Inspection shall be performed just after substantial completion. Provide copy of video for the Owner.

C. All pipe and fittings serving potable water systems shall be lead free and shall be certified by NSF International for drinking water.

PART 2 PRODUCTS

2.01 GAS PIPING SYSTEM (ABOVE GRADE)

A. Gas piping shall be schedule 40 black steel pipe.

B. Fittings shall be threaded malleable iron in sizes 2" and under and welding type in sizes 2½" and over.

C. All gas piping in return air plenum shall be welded.

D. See Section 22 1000 Pipe Fitting and Accessories - Plumbing for additional information.

2.02 GAS PIPING SYSTEM (BELOW GRADE)

A. Piping shall be medium density polyethylene.

B. The system shall be complete with non-corrosive mechanical non-pull out type couplings, steel to polyethylene non-pull out "O" ring protected transition fittings, and single seal anodeless gas risers.

C. See Section 22 1000 Pipe Fitting and Accessories - Plumbing for additional information.

2.03 GAS PIPING BELOW SLAB

A. When gas piping runs below slab, provide polyethylene sleeved, flexible steel corrugated gas piping.

B. Stainless steel tubing shall be made from 300 series stainless steel strip conforming to ASTM A240. Tubing shall be suitable for operation with Natural Gas and LP Gas (Propane). Tubing shall be rated for 5 psig pressure.

C. Protective sleeve shall be fire-retarded polyethylene and shall have ASTM E-84 flame spread rating not to exceed 25 and smoke density rating not to exceed 50. Polyethylene shall be resistant to UV. Protective sleeve shall be designed to withstand the superimposed loads. The sleeve shall have internal vent channels lengthwise to direct any leakage along the pipe to the end fittings. End fitting shall consist of AutoFlare fittings with a plastic containment coupling and ¼" NPT vent port to provide venting. ¼" diameter type K copper piping shall be connected to vent port on fitting, extend and terminate to outdoors.

D. No fittings are permitted under the slab of a building.

E. Piping system shall be TracPipe PS-II by Omega Flex.

PART 3 EXECUTION

3.01 PIPING GENERAL

A. Temporary Closures: During construction period, all rough-in plumbing shall be sealed off with test plugs and caps until fixtures are ready to be installed.

3.02 GAS PIPING TRACER

A. Install an insulated eight (8) gauge galvanized steel wire and yellow vinyl tape marked "GAS" in the same trench just above the piping. Steel wire and tape shall be continuous for the entire underground run of piping.

3.03 PRESSURE TESTS

A. All piping shall be pressure tested before insulation and concealment.

B. The following piping shall be tested to the pressure and for the period of time listed, and shall hold the specified pressure at the low point of the system for the specified length of time, without perceptible loss of pressure or leakage.

C. At the completion of the tests, the Contractor shall submit a letter on his letterhead certifying that the tests have been performed and listing the date of the tests.

1. Gas piping shall be air tested to 30 psig for two (2) hours without loss of pressure. Underground piping shall be tested prior to covering pipe. If piping does not hold pressure, then soap test and repair joints. Re-test piping to specified period until test holds.

END OF SECTION

SECTION 23 00 10
GENERAL PROVISIONS – HVAC

PART 1 GENERAL

1.01 DESCRIPTION

A. These Mechanical General provisions specified herein apply to all Sections of Division 23.

1.02 WORK INCLUDED

A. Provide all materials, labor and services as specified in Division 23 and shown on the accompanying drawings.

1.03 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the GENERAL PROVISIONS - HVAC, and are applicable to all MECHANICAL SECTIONS.
   1. Provide: Furnish, install and connect completely.
   2. Piping: Pipe installed with all required fittings, valves and accessories, and forming a complete system.
   3. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, and accessories completely installed.
   4. Power Wiring: Wiring which supplies the electrical current which flows through a connected motor or heater.
   5. Exposed: Revealed to view or subject to weather.
   6. Control, interlock and starting circuit wiring: All wiring required by all Mechanical Sections that is not power wiring.
   7. Fittings: All connecting pieces of a system.

B. Drawings: The Mechanical Drawings are diagrammatic except where specifically indicated otherwise. Refer to Architectural and Structural Drawings for building dimensions.

C. Materials: Refer to the GENERAL CONDITIONS. All material shall be suitable for the service and operating conditions of this Specification.

1.04 ABBREVIATIONS

A. The following abbreviations are used in this Division of the Specifications:

ASTM - American Society for Testing Materials.
AABC - Associated Air Balance Council.
ASME - American Society of Mechanical Engineers.
ARI - Air Conditioning and Refrigeration Institute.
SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
ANSI - American National Standards Institute.
NEMA - National Electrical Manufacturers Association
UL - Underwriters Laboratories, Inc.
AWWA - American Water Works Association.

1.05 APPLICABLE CODES

A. In the absence of any municipal adopted codes, the following shall apply:
   1. International Building Code, 2012 Edition, with Georgia Amendments (2014 and 2015).
   2. International Mechanical Code, 2012 Edition, with Georgia Amendments (2014 and 2015).
   3. ASHRAE Standard 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings
   4. All City, County, State, Regional, and other ordinances applicable to the work shall apply.

1.06 RELATED WORK

A. The following work is generally specified in other Divisions of the Specifications, except as specifically otherwise stated in this Division.
   1. Electric power wiring.
   2. Painting.
   3. Installation of access panels in walls and ceiling construction.

4. Installation of starters, contactors, thermal overload switches, and remote push buttons.
5. Curbs, other than pre-fabricated.
6. Flashing and pitch pockets around equipment on roof.

1.07 SPACE CONDITIONS

A. All work shall fit the spaces available in an approved manner. Verify all dimensions of the work before commencing fabrication and/or installation. Advise engineer of record if a problem exist before proceeding with any work.

B. Minor deviations from the drawings required to conform to space conditions and to provide the required operation, service, or maintenance accessibility shall be made at no additional cost, and subject to approval.

C. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panel boards, power panels, motor control centers, or dry type transformers:

Within 42" in front (and rear if free standing) of equipment; or
Within 36" of sides of equipment
Clearances apply vertically from floor to ceiling structures.

D. Hydronic piping shall not be installed above any electrical or control panels.

1.08 RECORD DRAWINGS

A. Upon completion of the Project, the Contractor shall submit one set of contract prints with red marks indicating As-built conditions of all piping, ductwork, and equipment, and incorporating changes made during construction. A record of as-built conditions shall be kept throughout the Project and shall be used in the preparation of the final record drawings.

B. The Contractor shall provide digital images (minimum resolution of 1152 x 864 pixels in JPEG standard image file format) delivered via email or on CD, of any utilities/piping that are installed underground with a reference drawing indicating which direction each picture is taken. The reference drawing shall dimension the utility/piping from a prominent fixed object.

1.09 GUARANTEES

A. Furnish a written guarantee covering each category of work.

B. Guarantee shall be furnished in exact conformity with the requirements of the General Conditions.

1.10 CONTINUITY OF SERVICE

A. All work shall be scheduled with that of other trades. The following conditions shall apply to all affected work.

B. Before disconnecting any existing systems for changes, the Contractor shall:
1. Have all materials needed stored at the job site.
2. Have assurance that all labor and skilled mechanics needed will be available at the proper time.
3. Estimate the time the system will be out of service and inform the Owner in writing.
4. Secure approval of the shutdown dates from the Owner in writing before disconnecting the system.

C. See General Conditions for correct procedures involving shut-downs of any utilities.

D. Work shall be done at such time and in such manner as to cause minimum inconvenience to the Owner and as approved by him or his representative. No allowance will be made for lack of knowledge of existing conditions.

1.11 EXISTING CONDITIONS

A. Existing systems and equipment where applicable shall remain unchanged except where otherwise specified or shown on the drawings.

1.12 OPERATING INSTRUCTIONS

A. Instructions: Instruct the Owner's representative in operation of the installed systems. The basis of these instructions shall be those written for inclusion in the maintenance and operating instruction data specified herein. Obtain certificates, signed by the Owner's representative, that these instructions have been received.

B. Notification: Notify the Owner at least five days before commencing operating period for heating equipment, as specified herein, in order that the Owner's representative may be present during that period.

1.13 DOCUMENTATION

A. Documents to be submitted prior to request for final inspection:
   1. Maintenance Manuals per Section 23 01 00.
   2. Test and Balance Report.
   3. Three copies of multi-year warranties bound in a brochure with index listing equipment.

B. Data to be Delivered at Final Inspection:
   1. Record Drawings.
   2. Certificate by Owner's representative confirming that operating instructions have been received.

1.14 SUBMITTALS

A. Procedure: Refer to the GENERAL CONDITIONS and SUPPLEMENTS thereto for submittal procedure of items called for in the Contract Documents.

B. Submittal data covering the work of this Division will be reviewed only after such items have been reviewed in detail and approved by the Contractor, such approval being indicated by suitable notations or stamp on the data.

C. Each submittal shall be clearly marked indicating Section and paragraph for which it is intended. Any deviations, exclusions or substitutions from specified material requirements shall be specifically identified in a summary sheet at the front of the submittal.

D. Where submittal sheets contain multiple products or selections, the specific item being submitted for review shall be clearly indicated with a red arrow (stamped or hand written). “Catalog” submittals (multiple items contained in the submittal, specific items not identified) will be rejected and not reviewed.

E. Submit the requested submittals in sufficient quantity to provide two copies in addition to those required by Contractor.

F. All fan submittals shall include performance curves indicating flow, pressure, efficiency, and power requirements. For fans, alternate RPM curves shall be included.

G. Motor Tabulation on all motors furnished listing the following nameplate data: Horsepower, voltage, phase and full load amps.

H. Submittal List: See the individual Mechanical Specification Sections for specific submittal requirements.

1.15 SHOP DRAWINGS GENERAL

A. Shop drawings shall be complete and shall accurately show all items of equipment and material called for. The number of drawings, and the view contained therein, shall be as needed to show the actual and final routing, construction, and final assembly of each system.

B. All drawings shall be mechanically produced. Free-hand drawings are not acceptable.

C. All lettering shall be legible without use or aid of magnifying device. Legible free-hand lettering will be acceptable. Lettering shall be minimum 1/8" size.

D. Date all shop drawings and provide a revision column.

E. Drawings shall be printed (or plotted) at either 24" high by 36" wide, or the same size as the contract drawings for the same trade, whichever is greater. Each drawing sheet shall be formatted the same as the Contract Documents (i.e., border width, title block, etc.). With the exception of Isometric drawings, all other drawings shall be drawn in two-dimension or at the same scale as the contract drawing of the same area, or as follows, whichever is the larger scale:

Drawing Type	Minimum Scale
Floor Plans	1/8" per foot
Roof Plans	1/8" per foot
Elevations	1/4" per foot
Details	3/4" per foot
Equipment Room Layouts	1/4" per foot
Housekeeping Pad Layouts	1/4" per foot
Isometrics	No scale
Riser Diagrams	1/4" per foot
Equipment Room Pad Layout with Electrical Stub-ups	1/4" per foot
All other plans and elevations	2" per foot

F. Three-dimensional views may be produced and used to provide supplemental information to that which is given on two-dimensional drawings. Three-dimensional drawings shall be drawn from a 30° perspective.

G. Each individual shop drawing sheet shall contain a single format (two-dimensional or three-dimensional).

H. In addition to information shown on the Contract Documents provide all additional data and notations needed to show conformance with Contract Documents. (i.e., air flow and volume from /to air devices).

I. For all drawings drawn two-dimension, all characteristics of the Contractor's equipment, systems and components shall be drawn to scale to designate their size. Use of dimensions alone to designate width, height, length, or depth is not acceptable. Drawings will not require that the reader "scale" them to determine sizes or location.

J. In the event either the project as a whole, or the specific area covered by particular a shop drawing, does not contain columns, floors and/or walls to which reference can be made in the location of items, alternate points of reference, as approved by the Architect, may be used.

K. Shop Drawings drawn at the same scale as the Contract Drawings shall incorporate the same areas, be arranged and be "broken" along the same lines as the Contract Drawings.

L. Duct and piping system which have following maximum width on one side shall be drawn in the following manner:

Drawing Scale	Object Dimension	Object Appearance Style
1. 1/8" per ft.	Greater than 8"	Double-line
2. 1/8" per ft.	Less than 8"	Single-line
3. 1/4" per ft.	Greater than 4"	Double-line
4. 1/4" per ft.	Less than 4"	Single-line
5. 1/2" per ft.	Greater than 2-1/2"	Double-line
6. 1/2" per ft.	Less than 2-1/2"	Single-line
7. 3/4" per ft.& larger	Greater than 2-1/2"	Double-line
8. 3/4" per ft.& larger	Less than 2-1/2"	Single-line
9. Flexible duct to diffusers	Single-line	

M. Coordinate with all other trades that might impact installation of other systems, equipment or components.

N. Each Shop Drawing shall contain a title block, which shall be the same size, layout and location, and have the same lettering size, as the Contract Drawings. Each drawing shall bear its own unique and descriptive designation. Adjacent to the title block shall be a space served for revision dates and identification.

O. Where adjacent areas of the building are continued on separate drawings, provide a "match-line" at the edge of the drawing area with an identifier directing the reader to the appropriate companion drawing.

P. Each plan view drawing shall contain a "key plan" of the entire building, or a major portion of the building, to allow for the quick identification of the work area covered by the specific drawing and the orientation of the building (or area) as a whole. The key plan shall be proportionally accurate but not to exceed 4" x 4" in size.

Q. The following minimum information shall be included on each plan view drawing; ceiling, soffits, ceiling grid, light fixtures, partitions, room name and number, columns and other structural members, doors and/or door swings.

R. Each drawing shall be revised to keep current with all modifications and revisions. Each modification shall be noted in the margin of each affected drawing. Notes shall consist of a unique modification number, date and brief notation on the reason for being made.

1.02 DUCTWORK SHOP DRAWINGS

A. Background information shall be redrawn scaled versions of the Architectural Floor or Reflected Ceiling Plans of the Contract Drawings and shall show all partitions, openings, and structural features. Drawings from the Contract Documents shall not be copied for use as backgrounds nor will reproducible drawings be made available from the Architect for this purpose.

B. Show fitting joints, fittings, equipment, required maintenance, removal and safe working clearances, elevations, location and sizes of access panels, net sizes (size of system less insulation), dimension from finished floor and/or overhead structure, horizontal dimension from centerline of columns, direction of flow, changes in size, changes in external covering, system material, construction classification, system name, internal liner, unique situations, equipment designation.

C. Show floor plan location of all space control and sensing devices (thermostats, humidistats, etc.) complete with the designation of the piece of equipment or component which device controls. Lines drawn between the sensing device to the controlled equipment or component, to designate their interaction, are not acceptable.

D. Sheet metal work shall be drawn using symbols and designations in accordance with the latest edition of "SMACNA Duct Construction Standards - Metal and Flexible".

1.03 HVAC PIPING SHOP DRAWINGS:

A. Background shall be the Ductwork Shop Drawings called for elsewhere in this Section except that notes and details pertinent to only ductwork may be omitted.

B. Show flanges, fittings, equipment, locations and sizes of access panels, required maintenance, removal and safe working clearances, elevations, net size (size of system less thermal or acoustical coverings), dimension from finished floor and/or overhead structure, horizontal dimension from centerline of columns, grade, percent of slope and/or rate of change, direction of flow, changes in size, changes in external covering, system material, construction classification, system name or symbol, unique situations, equipment designation.

C. Show floor plan location of all space control and sensing devices (thermostats, humidistats) complete with the designation of the piece of equipment or component which device controls. Lines drawn between the sensing device to the controlled equipment or component, to designate their interaction are not acceptable.

D. Piping shall be drawn utilizing the symbols and designations as shown on the Contract Documents.

E. Each piece of equipment or manufactured product shall bear the same designation as indicated on the Contract Documents.

1.04 EQUIPMENT ROOM SHOP DRAWINGS

A. Background shall be redrawn scaled versions of the Architectural Floor Plan showing all partitions, openings, and structural features.

B. Show actual size and location of equipment in both plan and vertical section.

C. Equipment and equipment pads (as required) shall be drawn to scale and dimensioned. Dimensions shall conform to actual manufacturer's dimensions for product used.

D. Show dimensions of equipment placing relative to partitions, columns, beams, and underside of structural deck.

E. Show and dimension all service clearances, access door swings, vertical clearances.

F. Show all piping, breaching, and equipment to provide full information for coordination.

G. Show electrical panels to scale, including control panels and disconnect switches.

END OF SECTION

SECTION 23 01 00

OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 GENERAL

1.01 MAINTENANCE AND OPERATING MANUALS

A. Provide manual in number of copies indicated under Section 23 00 10 - General Provisions - HVAC.

B. Material submitted in the manuals shall represent the equipment manufacturer, model, and type installed on the project.

PART 2 PRODUCTS

2.01 MAINTENANCE AND OPERATING MANUALS

A. Maintenance and Operating Manuals shall consist of the following as a minimum:
   1. Hardback three ring binders with job name and Owner's name and work order (WO #) and Bid number on the cover.
   2. Typed index listing name, address, and phone number of the General Contractor, HVAC Subcontractor, Insulation Subcontractor, Sheetmetal Subcontractor, and Controls Subcontractor, and all major equipment suppliers.
   3. Typed table of contents, listing each Section, title, and number.
   4. All Sections shall be tabbed with plastic tabs listing Section numbers.
   5. Each item of equipment requiring maintenance and operation data as noted in each specification section shall be provided with an index listing the types of equipment installed. Submittal data shall be included to the extent necessary to identify equipment, including summary sheet, such as model, size, air or water flow, pressure developed, speed, and motor size. Instructions shall include type and suggested frequency of maintenance, oiling, cleaning, disassembly, and reassembly directions, and wiring diagrams.
   6. Make, model, serial number and purchase order number of every item of equipment shall be identified on all documentation
   7. One section shall include a complete set of record control drawings, bound in a plastic insert, full size, complete with a written sequence of operation for all control systems.
   8. Letters, where factory startup or checking has been required, certifying completion of performance.
   9. Provide three (3) hard copy sets and one electronic set of all aforementioned items in PDF format to the owner.
   10. Contractor's signed warranty letter certifying all work has been completed as required and stating what date warranty shall end.
   11. Table showing all major pieces of equipment and when the warranty of the equipment expires.

PART 3 EXECUTION

3.01 MAINTENANCE AND OPERATING MANUALS

A. All maintenance and operating manuals shall be complete and ready to turn over to Owner's representative at final inspection.

B. Incomplete manuals will be returned to the Contractor for complete resubmission. Loose-leaf submittal of material at various stages of completion will not be acceptable.

C. Contractor to submit to Engineer of Record for review 2 weeks prior to completion of project.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 DESCRIPTION

A. This section of specifications deals with materials and methods pertaining to all work specified under Division 23.

1.02 RELATED SECTIONS

A. Section 23 00 10 General Provisions Mechanical

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide submittal data showing starter dimensions, weight, electrical requirements, and service access requirements.

C. Provide submittal data showing motor horsepower, electrical requirements, and efficiency.

D. Provide submittal data showing firestop systems, including details for penetrations and instructions for installation

E. Provide manufacturer's instructions, indicate installation and support requirements.

F. Provide submittal data on Fire Stopping and associated wall labeling signage.

1.04 JOB CONDITIONS

A. Install all apparatus so as to maintain maximum headroom and clearances consistent with requirements of the drawings and specifications.

B. All equipment requiring service shall be installed to permit access for servicing without damage to building structure or finishes.

PART 2 PRODUCTS

2.01 DRIVES

A. Belt drives shall be sized for 150% of motor horsepower. Motor pulleys shall be cast iron, adjustable pitch for 15 hp and below, fixed pitch above 15 hp.

B. Drive speeds scheduled are estimated; provide fixed or adjustable pitch sheaves necessary to deliver scheduled air quantities based on actual static pressure in the system.

C. Multiple belt drives shall be used on motors 5 horsepower and larger.

2.02 DRIVE GUARDS

A. Drive guards shall be provided for all driven equipment. Drive guards shall be designed to meet OSHA requirements. Belt guards shall be constructed to meet SMACNA Low Pressure Duct Construction Standard, 1985, Appendix Figure 31.

B. Belt drive guards shall be constructed of galvanized expanded metal reinforced with galvanized angle steel frame. Guard shall be welded or formed of one piece of material.

C. Provide minimum 3" diameter access plate at motor shaft and driven apparatus shaft for belt guards. Access plates shall be attached with aircraft type locking wing nuts.

D. Drive guards shall be rigidly bolted to the frame of the equipment. All drive guards shall be removable.

2.03 MOTORS

A. Provide motors for all equipment required by the Mechanical Sections unless otherwise specified. Motors shall operate using Electrical characteristics shown on the Drawings and as specified. Multiple units of the same manufacturer's equipment shall be furnished with motors by one manufacturer. Motors shall be Century, Gold, Louis-Allies, Reliance, General Electric, Balder, Westinghouse, Marathon, or US Motors, except where furnished as part of packaged equipment.

B. Standards: Except where otherwise specified, motors shall be manufactured according to NEMA Standards. They shall be NEMA Design B, Continuous Duty, 1.15 service factor, Insulation Class F, 40ºC. ambient and 40ºC. rise. Hermetic motors shall be manufactured according to ARI Standards.

C. Efficiency: All design A & B squirrel-cage, foot mounted, single speed T-frame induction motors 1 hp and larger having synchronous speeds of 3600, 1800, and 1200, rpm shall have a nominal full-load motor efficiency no less than that shown below or shall be classified under NEMA standard as “ENERGY EFFICIENT”: Please see the chart entitled “Minimal Nominal Full-Load Efficiencies (%)” at the end of this section.

D. Sizes:
   1. Motors with standard NEMA Electrical characteristics shall be selected for the design brake horsepower without overload current at rated voltage. Motor horsepower rating shall not exceed 125% of the calculated maximum load being served. If a standard rated motor is not available within the range, the next larger standard motor size shall be used.
   2. Motors with special electrical characteristics, such as hermetic refrigeration motors, shall be selected to product the brake horsepower required for the specified load without overload current at rated voltage.
   3. Motors used with variable speed adjustable frequency controllers shall be suitable for inverter duty use, constructed in compliance with NEMA Standard MG 1-1998 Part 31 and selected to operate with the control characteristics and amperage limitations of the specific inverter selected.

E. Enclosures: Motor enclosures shall be open drip-proof, except where otherwise specified. Motors for equipment installed where subject to weather shall be fan cooled, totally enclosed weatherproof type, unless fully protected by a waterproof housing.

F. Nameplates: All motors shall have a nameplate showing the specified nominal system voltage as nameplate rated voltage. Each motor shall be guaranteed to operate satisfactorily at the specified nominal system voltage, plus or minus 10%.

2.04 CONTACTORS

A. Contactors shall be magnetic designed for resistance heating and tested for 100,000 cycles. Contacts shall be silver alloy. Enclosure shall meet the requirements of U.L. 508 with NEMA Type 1 indoors, and Type 3R outdoors. Provide one set of auxiliary contacts and control transformer with fused, grounded secondary. Holding coil voltage shall not exceed 120 volts.

B. Manufacturers: Clark Controller, Arrow-Hart, Cutler-Hammer, Allen-Bradley, Square D, Joslyn Clark, or Furnas.

2.05 STARTERS

A. Manufacturers: Cutler-Hammer, Square D, Furnas, Joslyn Clark, or Allen-Bradley.

B. Except as otherwise specified, furnish starter, providing thermal overload protection, for each motor specified herein. Overload elements shall be sized to protect motors. Overload protection shall be provided in each motor leg. Auxiliary contacts, NEMA A600 rated, shall be provided for wiring specified under "Controls". Contacts shall be Form C type, open on alarm. Provide two spare normally open and two spare normally closed contacts. Starters shall be constructed and rated for 50,000 amps withstand rating.

C. Unless noted otherwise, all automatically controlled motor starters shall be furnished with "hand-off-auto" selector switch, reset button and LED pilot light in cover.

D. All three phase starters serving motors over 208 volts shall have control transformer with fused 120 volt secondary. Holding coils shall be 120 volt. Provide overload protection for each of three phases. Enclosures shall be NEMA Type 1 for indoor locations and NEMA Type 3R for outdoor locations, unless otherwise noted.

E. All manual single phase starters shall be furnished with LED pilot light, NEMA Type 1 enclosure indoors, and NEMA Type 3R outdoors. Starters located in finished spaces shall be furnished with flush mounting enclosures.

F. Provide engraved plastic nameplate for each starter with description of equipment served. Nameplate shall state source of circuit, load served, circuit number if used, voltage and phase.

G. Provide combination undervoltage/anti-single-phase protection relay, Time Mark Model 265, installed inside starter enclosure.

H. Provide oversized starter enclosures where required to enable installation of Time Mark device, specified above.

2.06 SUPPORTS AND HANGERS

A. Individual horizontal piping shall be supported as follows:
   1. Steel piping with painted clevis hangers.
   2. Hangers in contact with copper piping shall be copper plated swivel ring type.
   3. Hangers around insulated copper piping shall be galvanized steel swivel ring type.
   4. Copper piping exposed adjacent to structure shall be secured with copper plated pipe clamp.
   5. All attachments in contact with copper piping shall be copper, copper plated or plastic coated.
   6. Horizontal, parallel and adjacent piping shall be supported by gang hangers utilizing PVC coated channel and PVC coated standard pipe clamps or approved equal.

B. Concealed vertical piping shall be supported as follows:
   1. Steel and cast iron piping with painted riser clamps.
   2. Copper piping with copper plated riser clamps.

C. Exposed Vertical Piping shall be supported by attachment to wall at midpoint with offset pipe clamps. Clamp for uninsulated copper piping shall be copper plated or plastic coated.

D. Pipe in Chases:
   1. Piping in pipe chases shall be secured to building structure using attachments hereinbefore specified. Hangers for water piping within plumbing chases shall be supported with rods bolted to pipe clamps which shall be affixed to cast iron pipe. Piping may be supported from the more rigid cast iron pipe with the use of plastic brackets designed for that purpose.

E. Hangers and pipe attachments, except where otherwise specified shall be Elcen, Michigan Hanger Company, B-Line, or Grinnell.

2.07 STRUCTURAL ATTACHMENTS

A. Concrete Fasteners:
   1. Fasteners shall be self-drilling type, Locke Mfg. Co. "Bull Dog", Phillips "Red Head", or Diamond "Blue-Cut".
   2. Fasteners shall be used in solid masonry walls and shall be used in solid concrete walls.

B. Toggle Bolts with not less than 1/4" diameter bolts shall be used in hollow type wall construction.

C. Clamps of configuration compatible with beams and steel members shall be used in steel construction. Clamps shall be Grinnell, Michigan Hanger Company, Elcen, or B-Line.

D. Hanger rods shall be selected to safely carry the load to be supported and shall not be less than the diameter listed by the hanger manufacturers for the specific size hanger used.

2.08 PAINTING

A. Primers shall be acrylic, corrosion resistant type, selected for the metal or other surface to be painted, with a maximum VOC emission of 150 grams per liter. Sherwin-Williams Pro-Cryl Universal Primer or equal.

B. Topcoats shall be acrylic latex base, selected for the material, surface and operating temperature of the equipment or apparatus to be painted, with a maximum VOC emission of 150 grams per liter for non-flat finishes and 50 grams per liter for flat finishes. Sherwin-Williams Pro-Mar 200 (interior metal, black-out), Sherwin-Williams SuperPaint (exterior metal), or equal.

2.09 FIRESTOP SEALANT

A. Firestop sealant shall be a synthetic elastomer caulk, strip, or sheet designed for use as a one part fire, smoke, and gas sealant. Material shall be intumescent and capable of being installed with caulk gun, shears, and putty knife. Material shall be UL classified and Factory Mutual approved for sealing in floors, walls, or partitions to 3 hour rating per ASTM E-814.

B. Fire barrier material shall be 3M Fire Barrier Sheet, Strip, and Caulk.

C. Contractor shall be required to provide verification of purchase to owner of product provided for fire stopping penetrations through rated partitions.

D. The owner reserves the right to verify that the correct thickness of material has been provided at fire-stopped penetrations by cutting out sections at random at no extra cost to the contract.

E. Fire stop installer shall post labels at all fire stopped penetrations to identify “hour rating”, UL System, etc. Submit samples with shop drawing submittals.

F. The installing contractor shall be trained and authorized by the manufacturer of the fire stop product used to do the work; authorization shall be included in product submittals.

G. The manufacturer’s local representative shall be required to periodically visit the site to review the work done and make recommendations to the owner on the work done. A site visit report shall be submitted to the owner.

H. Floor penetrations in all mechanical spaces shall be sealed and water-proofed.

2.10 ASBESTOS: All materials used in this work shall be asbestos free.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be installed plumb and square unless clearly indicated otherwise. Installation shall be performed by competent persons, trained in their respective skills.

B. Furnish and install equipment complete, including connections, services and adjustments for systems to operate safely and in compliance with requirements of the contract.

C. Install each item in full compliance with current recommendations of the manufacturer. Equipment manufacturer or his authorized representative shall furnish services and/or supervision necessary to ensure compliance with this provision. Conflict between manufacturer's recommendation and other contract requirements shall be resolved before installation.

D. Requirements of the several acceptable manufacturers for each specified item of equipment may vary as to installation details, location and number of connections, dimensions and weight. Provide all drawings, services, material, and labor necessary for the installation and proper functioning of the equipment furnished.

3.02 PROTECTION OF MATERIALS AND EQUIPMENT

A. Take precautions to protect all materials and equipment from damage during the construction process.

B. Do not store materials and equipment outdoors subject to weather without complete weather protection.

C. Do not install materials or equipment in a partially constructed structure exposed to weather, unless all material and equipment is continuously protected from damage by weather or the construction process.

D. Material and equipment damaged by improper protection during construction is subject to replacement based on the judgment of the Engineer at no cost to the Owner.

3.03 CUTTING AND REPAIRING

A. Cut and repair all walls, floors, and ceilings necessary for the installation of the mechanical work, but no cutting of work of other trades will be permitted without the consent of the Architect or his representative.

B. All cutting and repairing of walls, floors, and ceilings shall be subject to the supervision and approval of the Architect or his representative.

3.04 CLEANING AND FINAL CLEAN-UP

A. Keep the premises free of waste, debris and surplus materials.

B. After equipment has been installed, remove all extraneous materials, rust and stains; blow, vacuum or flush all foreign matter from all equipment.

C. Identification plates on equipment shall be free of paint and shall be polished.

3.05 DRIVES AND GUARDS

A. All belt drive alignments shall be properly checked and set prior to starting machinery.

B. Adjust drives to deliver air quantities scheduled at actual static pressures. Change sheaves to meet actual conditions, if required.

C. Provide one set of spare belts to be turned over to the Owner at the completion of the work for each fan unit drive.

D. All equipment guards shall be OSHA compliant and installed prior to operation of equipment.

3.06 MOTOR VOLTAGES

A. All motor voltages shall be checked with the electrical drawings prior to preparation of submittals or ordering of equipment.

3.07 MOTOR STARTER OVERLOADS

A. Motor overload heaters shall be sized and installed to protect the actual motor furnished.

3.08 PIPING SUPPORTS AND ANCHORS

A. Combination riser clamps may be used where more than one pipe passes through floors.

B. Riser clamps for support of risers shall span penetration of slot or sleeve in floor. In exposed location, use short span clamps.

C. Hang all piping so that equipment flanges and connections bear none of weight of piping. At pump suction and discharges, piping shall be supported free of pump casing through the use of base elbows.

D. Horizontal supports shall be spaced as follows:
   1. Steel piping at not more than 10' intervals.
   2. Copper piping 1-inch and smaller at 8' intervals; larger than 1-inch at 10' intervals.

E. Vertical supports shall be spaced as follows:
   1. Steel piping at every other story height.
   2. Copper piping larger than 1-inch at every other story height; 1-inch and smaller at every story height.

3.09 HANGER SIZES

A. Hangers shall be sized to fit the pipe except for the insulated piping, in which case hangers shall be of size for pipe and insulation to pass through.

B. See Insulation for Pipe Saddles.

3.10 STRUCTURAL ATTACHMENTS

A. Inserts shall be used for individual loads exceeding 150 lbs. Concrete fasteners may be used where approved in writing by Architect for individual loads of 150 lbs. or less.

B. Inserts shall be secured to the forms before the pouring of concrete. In all spaces with exposed concrete ceilings, the openings not filled with rods and nut shall be filled with cement grout flush with the ceiling.

C. Shooting of fasteners into the slab shall be allowed only in approved locations.

D. Devices for connection to the structure shall not be loaded more than 75% of the manufacturer's rated load.

3.11 PAINTING

A. Except where otherwise specified, painting shall be done under another Division. Surfaces shall be left clean and free from oil.

B. Finishes of factory painted apparatus shall be touched up where finish is marred in installation.

C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.

D. Interior ferrous pipe and supports exposed to view without removing ceilings or access panels shall be primed and topcoated with two coats of semi-gloss paint, color selected by Architect.

E. Exterior ferrous piping and supports shall be primed and topcoated with two coats exterior satin finish paint, color selected by Architect.

F. Exhaust fans shall be identified as specified in this section.

3.12 FIRESTOP SEALING FLOOR AND WALL PENETRATIONS

A. Where ductwork, piping, control tubing, and conduit penetrate fire or smoke rated walls and floors, the penetration shall be sealed with fire barrier herein specified.

B. Fire barrier shall be installed in strict accordance with manufacturer's printed instructions. Material shall be installed with sufficient depth to maintain a fire endurance rating equivalent to that of the adjacent wall or floor.

3.13 LUBRICATION

A. All equipment installed under this division shall be properly lubricated in accordance with the manufacturer’s instructions and recommendations before it is operated during the installation period, and shall be checked again before final acceptance.

END OF SECTION

SECTION 23 05 29
EQUIPMENT SUPPORTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the equipment support rails and pipe caps.

1.02 RELATED SECTIONS

A. Section 23 05 00 Common Work Results for HVAC

B. Section 23 31 00 Ductwork

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide shop drawing showing dimensions, materials of construction, size and quantity provided.

C. Provide manufacturer's instructions, indicate installation and support requirements.

1.04 QUALITY ASSURANCE

A. Curbs and roof supports shall be constructed per the National Roofing Contractors Association requirements.

B. Curbs shall be designed to support the actual equipment to be installed.

PART 2 PRODUCTS

2.01 EQUIPMENT SUPPORT RAILS

A. Rails shall be 12" high heavy gauge galvanized steel rails with continuously mitered and welded corners, raised cant and galvanized counter flashing over pressure-treated wood nailer.

B. Rails shall be PATE ES-5 or equal by Portals Plus, Roof Products and Systems Corporation, or Curbs Plus, Inc.

PART 3 EXECUTION

3.01 SUPPORTS

A. Support roof mounted exhaust fans on equipment support rails.

3.02 ATTACHMENTS TO CURBS AND RAILS

A. Secure equipment to curbs with lag screws maximum 18" O.C.

B. Bolt equipment with legs to equipment support legs at all support points.

END OF SECTION

SECTION 23 05 93

TESTING, BALANCING, AND ADJUSTING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the requirements for testing and balancing the Heating, Ventilating, and Air Conditioning Systems.

1.02 RELATED SECTION

A. Section 23 00 10 General Provisions HVAC

1.03 QUALIFICATIONS

A. The test and balance work shall be performed by an independent firm certified by the Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB). Acceptable Test and Balancing agencies shall be Air Analysis of Atlanta, Thomas Balancing of Macon, Test and Balance Corporation and Research Air Flo.

1.04 PROCEDURES

A. All air distribution systems and hydronic systems shall be tested, adjusted, and balanced to the conditions specified and/or shown on the drawings.

B. Performance of systems and components at specified conditions shall be verified by testing.

C. Before request for final inspection, calibrate, adjust, set, test and check all valves, dampers, temperatures, pressures, and flow rates of systems for operation and performance.

D. All test and balance work shall be performed in accordance with AABC or NEBB procedures.

E. Review the proposed systems installation drawings and determine if all measuring and balancing devices required for proper test and balance of the systems are specified and sized correctly.

F. Check that proposed ductwork layouts allows duct pitot traverses to be performed correctly to allow overall air flows.

G. The Test and Balance contractor shall read and implement the Test and Balance Plan of Action shown below.

1.05 REPORTS

A. Submit completed and certified report to Architect in triplicate or in printable electronic format.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all instruments, charts, materials, and equipment required to develop a complete test and balance report.

PART 3 EXECUTION

3.01 TEST AND BALANCE REPORT

A. Test and balance report shall be a complete document and shall state specified design and actual measured/balanced levels. Report shall include at a minimum but not limited to, at least the following:
   1. Air side of systems:
      a. All air unit component pressure drops.
      b. Fan RPM and entering and leaving static pressure.
      c. Air flow readings for all diffuser outlets and exhaust grilles.
      d. Space temperatures at thermostats.
      e. Manufacturer’s performance curves, tables and graphs.
   2. Electric Motors:
      a. Full load amperes, voltage, and horsepower.
      b. Installed starter heater size.

3. Controls:
   a. Calibrate all control elements and check operation including all interlocks.
   b. Aide in adjusting all control systems to optimize energy use for all associated equipment.
   c. Coordinate, aide and verify in located of sensors and to help ensure that sensor locations shall be free from drafts, heat sources or other factors that may affect the accuracy of the control system. Coordinate any change in sensor location with engineer prior to commencing work.
4. Total Systems: Contractor shall check all systems operating together, in all modes of operation, to ensure that the air conditioned spaces are in an overall positive pressurization state.
5. Building: Overall building and individual spaces air balance and pressurization levels.
6. General: Report shall include a list of all deficiencies found during the preliminary testing and a contractor response indicating remedial action taken for each item. The TAB work shall not be deemed finished without this report.

3.02 BALANCING AND ADJUSTMENT AFTER FINAL INSPECTION

A. After final testing and balancing is completed and accepted, send qualified personnel to building for not less than one period during summer and one period during winter, observe temperatures throughout conditioned spaces, consult with Owner's representative as to need for additional balancing or adjustment, then perform such work as is indicated. The test and balance activities performed for Material Completion shall not be considered a seasonal TAB.

B. Schedule these visits, at a time agreeable to Owner, during December through February for heating, and July through August for cooling. The summer seasonal TAB should be performed while occupied during near peak seasonal conditions with minimum and maximum OA temperatures specified for summer and winter TABS.

C. Notify the owner at least a week in advance of the seasonal TABs requesting that the filters be clean (if required) prior to the TAB and all the systems will be ready and operational for the seasonal TAB. Occupancy is not required for the winter seasonal TAB.

3.03 TEST AND BALANCE PLAN OF ACTION

A. The general contractor shall incorporate the TAB into the overall construction project to ensure that enough time is allowed for the testing and balancing contractor to complete the total system balancing according to a balancing plan prior to the completion date defined by the construction schedule. Final TAB shall be complete a minimum of 4 weeks prior to occupancy.

B. TAB shall not be started until the building envelope is completed, ceilings installed, interior and exterior doors and windows are in place.

C. A balancing plan prepared by the balancing contractor shall cover balancing techniques and testing procedures for all individual systems and equipment as well as for the overall system.
   1. The plan shall include:
      a. A list of the test instruments that are planned to be used in the testing and balancing process.
      b. A description of the testing procedure for each HVAC system to be tested. List all of the equipment to be tested for each system and the techniques to be used for the testing procedure. Standard forms used by the TAB agency association shall be completed to reflect all equipment and systems identified by system and/or model number specific to the project. Blank, “sample” forms are unacceptable.
      c. A list of the all contractors that are required to assist with the testing and balancing process along with the expectations of each of the contractors to successfully complete a total system balance. Most importantly, the expectations of the BAS contractor shall be listed. This shall include provision of automation software for balancing, timely automation system access, and the development of global overrides for system maximum performance testing.
      d. An outline of the required construction completeness prior to <u>starting</u> the testing and balancing process

e. A realistic estimate of the time required to complete the testing and balancing process; the plan shall describe in detail the required time to complete balance of sub-systems and total system balance. The general contractor shall recognize that the balancing process sequential and not a process that can be shortened by simply putting more technicians on the project to complete the process faster. Buildings with direct digital control systems require a great deal of the testing and balancing process to be performed through adjustments to the HVAC systems via the automation/control system. Network access limitations and/or control software may prevent more than one operator from communicating with the automation/control system at a time. This makes it inefficient to have too many balancing technicians on a single project if the majority of the adjustments can only be made through one computer terminal.

f. A listing of the necessary uninterrupted accessibility to the building to completely test HVAC equipment and sub systems.

g. The general contractor shall allow time in the balancing plan schedule to allow the balancing contractor to address any issues in the design or installation, which prevents a system from operating at design performance. The general contractor shall take the time for resolution of these issues by the responsible party into account in the balancing schedule. A ‘contingency’ of an additional week or two should be incorporated into the balancing plan schedule to accommodate additional time required for the responsible party to correct any minor issues preventing design performance of the building.

h. Building accessibility during balancing

(1) The balancing contractor shall be provided uninterrupted access to all areas of the building. Large HVAC systems may require the access to the same area several times throughout the balancing process. Finishing processes of the building construction such as laying carpet and tile flooring, waxing floors, construction cleaning, and fire alarm testing that require the HVAC systems to be shut down shall be identified in the balancing plan to inform the construction manager of possible conflicts who shall attempt to schedule the testing and balancing process around them. Some building accessibility issues to address in the balancing plan include the following:

i. Flooring work, such as carpet laying and tiling, must be performed either before or after the testing and balancing process for a particular system serving the area in which the flooring work is to be done. If the completed flooring will restrict the use of boom lifts, the testing and balancing of the system serving that area shall be completed before the floor work if the HVAC system components are inaccessible by ladder.

ii. Final building cleaning that would prevent further access of contractors shall be delayed until the testing and balancing is completed.

iii. If fire alarm testing will affect the HVAC system, the balancing contractor should be notified in advance when fire alarm testing is scheduled. For example, closing fire dampers or shutting down air handling units can disrupt total system balancing.

D. A detailed balancing plan shall be submitted for all projects at the same time as mechanical submittal data. The balancing contractor shall follow up with the general contractor to ensure that the balancing plan has been properly reviewed and incorporated within the construction schedule.

END OF SECTION

SECTION 23 31 00
DUCTWORK

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the sheet metal requirements for Division 23 ductwork.

1.02 RELATED SECTIONS

A. Section 23 05 00 Common Work Results for HVAC

B. Section 23 05 93 Testing, Balancing and Adjusting

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide data on damper performance including, but not limited to, total static pressure drop verses airflow shown for all multi-blade dampers, size and quantity of dampers required.

C. Provide shop drawing showing multi-blade damper dimensions, construction, duct connection sizes and electrical requirements.

D. Provide manufacturer's instructions, indicate installation and support requirements.

1.04 STANDARDS

A. Refer to the SMACNA "HVAC Duct Construction Standards, Metal and Flexible ", Third Edition, 2005, latest printing published by SMACNA.

B. Refer to the SMACNA "Duct Cleanliness for New Construction Guidelines", latest printing published by SMACNA.

C. Unless noted otherwise herein, all ductwork shall be constructed, sealed, and supported in strict compliance with the SMACNA standards referenced above.

D. UL 181A Closure Systems for Use With Rigid Air Ducts.

E. Refer to the SMACNA "IAQ Guidelines for Occupied BUildings Under Construction", First Edition, 1995, for both new construction and renovation work.

1.05 PRESSURE AND VELOCITY RATINGS

A. For all ductwork required to be constructed and reinforced for over 2" positive or negative pressure, submit a Ductwork Reinforcing Schedule. This schedule shall indicate size, metal gauge, and reinforcement size and spacing, for all ductwork over 2" pressure class.

1.06 DUCT DIMENSIONS

A. Duct sizes shown on drawings provide the minimum cross-sectional area required. Increase overall duct dimensions as necessary to accommodate duct liner thickness.

PART 2 PRODUCTS

2.01 METAL MATERIALS

A. Sheetmetal shall be hot dipped galvanized steel of lock forming quality with minimum zinc coating of 1.25 ounces per square foot each side (SMACNA G-90) per ASTM A 525. Exposed duct to be painted shall be baked off white enamel.

B. Formed reinforcing drives, slips, pocket locks, and standing seams shall be constructed from sheet metal stock of the same material as the associated ductwork. Intermediate reinforcing angles may be uncoated steel painted with two coats of primer.

2.02 ELASTOMERIC FLEXIBLE DUCT LINER

A. Internal flexible, closed-cell non-wicking elastomeric liner shall be pinned, fabricated factory-applied duct insulation with a self-adhering backing in sheet form. Liner shall meet the requirements of ASTM C 534 for elastomeric insulation. Insulation shall be made with an EPA registered, anti-microbial agent to guard against potential growth of fungus and bacteria and shall meet UL181 for mold growth, and ASTM G21 and G22 for fungi and bacterial resistance. Duct liner shall be 2” thick acoustical rated, minimum 3lb density, with surface suitable for duct velocities to 6000 f.p.m. without erosion. Thermal conductivity shall not exceed 0.27 at 75°F and a maximum water vapor transmission of 0.08 perm-inches. Liner shall be manufactured without the use of CFCs, HFCs or HCFCs and shall be formaldehyde free, low VOC, fiber free and dust free. Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ASTM E 84.

2.03 LINER ADHESIVE

A. Liner adhesives shall be low VOC, water based, meeting the requirements of the liner manufacturer. Products used must comply with the current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule #1168, with a maximum VOC emission of 70 grams per liter. They shall be manufactured by the insulation manufacturer or by Ductmate, Foster, Hardcast, United McGill or 3M.

2.04 CONTROL DAMPERS

A. Control dampers shall be multi-blade opposed action type. Frames shall be formed 16 gauge galvanized steel channel with corner braces above size 20 inches wide and 20 inches high. Maximum individual damper width shall not exceed 48”. Blades shall be 6 inches (maximum) wide, constructed of 16 U.S. Gauge (minimum thickness) formed galvanized steel attached to cold-rolled galvanized steel axles. Axle bearings shall be self-lubricating nylon or Teflon. Damper shall be controlled by factory assembled operating linkages concealed in the frame outside of airstream, constructed of galvanized steel. Individual actuators shall serve a maximum of 30 square feet of damper area. Provide additional actuators for larger areas. Ruskin CD35 or equal by Arrow United, Cesco, Greenheck, Leader or National Controlled Air.

B. Dampers opening to outdoors shall be provided with jamb seals and blade seals. Seals shall be provided for all control dampers with rated operating range from -40°F to 180°F. Jamb seals shall be stainless steel and blade seals shall be compressible neoprene, PVC coated polyester fabric, synthetic elastomer or extruded vinyl. Blade seals shall be replaceable. Leakage rate for dampers opening to outdoors shall not exceed 11 CFM per sq. ft. at 1” static pressure when measured in a 48” x 48” size. Leakage rate shall be AMCA certified. Ruskin CD36 or equal by Arrow United, Cesco, Greenheck, Leader or National Controlled Air.

PART 3 EXECUTION

3.01 GENERAL DUCTWORK INSTALLATION

A. All ductwork shall be fabricated, stored and installed per the SMACNA Duct Cleanliness Guidelines for Intermediate Level Cleanliness. This guide includes the requirement for ducts to be stored in a clean, dry area, the installation area shall be protected from the elements, and temporary closure of open ends on completed ducts, and other measures intended to minimize contamination of the circulating air.

B. Ducts over 12" in either dimension, except those to be externally insulated with rigid board or internally insulated, shall have all sides cross.

C. Leave system clean from dust, trash and foreign matter.

D. Installation shall be air tight and free from rattles, vibration and movement.

3.02 DUCTWORK SUPPORT

A. Ductwork shall be supported per SMACNA standard except hanger spacing shall not exceed 8' for rectangular duct and 10' for round rigid ductwork.

3.03 LOW PRESSURE DUCTWORK

A. Squared and radiused elbows shall be constructed as per figure 2-2, except no mitered elbows or square elbows without vanes are allowed. Turning vanes shall be constructed as per figures 2-3 and 2-4.

B. Divided flow branches shall be constructed as per figure 2-5, always with splitter damper.

C. TDC and TDF duct joint systems may be used as outlined in SMACNA manual, provided corner pieces are used and bolted at all locations.

3.04 MEDIUM PRESSURE DUCTWORK

A. Rectangular ductwork shall have only radiused elbows, with radius equal to 1½ times the duct width wherever possible. Where radius is less than 1½ times the duct width, turning vanes shall be installed as per figures 2-3 and 2-4.

B. Divided flow branches shall be constructed as per figure 2-5, except no splitter dampers are to be installed.

C. TDC and TDF duct joint systems may be used as outlined in SMACNA manual, provided corner joints are bolted at all locations.

3.05 DUCT SEALING

A. Seal Levels:
   1. Seal level A - Seal all transverse joints, longitudinal seams, and all duct wall penetrations.
   2. Seal Level B – Seal all transverse joints and longitudinal seams.
   3. Seal Level C – Seal all transverse joints.

B. Seal Procedures:
   1. All longitudinal and transverse joints, seams and connections in and between metallic and non-metallic ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards.
   2. Seal joints per SMACNA procedures with duct sealer as duct is erected. Sealing ductwork after erection is complete will not be accepted. Cover all joints to be sealed with sealer and assemble in normal fashion. Duct Seal Levels are as follows:
   3. For Seal Level A and B: Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL-181B by and independent testing laboratory and the tape is used in accordance with that certification.
   4. Where ductwork is bolted together, provide 1/8" thick gaskets at each bolted joint.
   5. Spiral lock seams in a round orflat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps, and other branch connections, access door frames and jambs, duct connections to equipment, etc...
   6. Closure systems used to seal factory-made rigid air ducts or air connectors shall comply with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181A-M" for mastic or "181A-H" for heat-sensitive tape.
   7. Closure systems used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic.
   8. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply UL-181B and shall be marked "!181B-C".
   9. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
   10. Unlisted duct tape is not permitted as a sealant on any duct.

C. All low pressure ductwork shall be sealed as follows:
   1. Exterior – Seal Level A, except for exhaust ducts, which shall be Seal Level C.
   2. Unconditioned Interior Space – Seal Level B except for exhaust ducts, which shall be Seal Level C.
   3. Plenums or Conditioned Space – Seal Level C, except for exhaust ducts, which shall be Seal Level B.

D. All medium pressure ductwork and all ductwork that will operate at over 2" static pressure shall be sealed as follows:
   1. Exterior – Seal Level A, except for exhaust ducts, which shall be Seal Level C.
   2. Unconditioned Interior Space – Seal Level A except for return ducts, which shall be Seal Level B, and exhaust ducts, which shall be Seal Level C.
   3. Plenums or Conditioned Space – Seal Level B, except for return ducts, which shall be Seal Level C.

3.06 ALUMINUM EXHAUST DUCTWORK

A. All aluminum exhaust ductwork shall be watertight using silicon sealed joints. Slope ductwork back to grilles 1/32”/ft. No traps allowed in aluminum exhaust duct systems.

3.07 DUCT LINER AND FINISH

A. All portions of ductwork or plenums designated to be lined shall be completely covered with duct liner. Fasten duct liner to sheet metal with coated surface facing the airside and secured with ASTM C 916 compliant adhesive with 100% coverage and mechanical fasteners per the requirements of the above referenced SMACNA manual. Mechanical fasteners shall not compress the insulation more than 1/8” and shall be spaced per the SMACNA manual guidelines.

B. Metal nosing shall be provided at transverse edge of liner facing the fan discharge when air velocities exceed 2000 F.P.M. or at any point where lined duct is preceded by unlined duct. Locate mechanical fasteners within 3" of leading edge of liner across entire face. Butt liner joints together to form a continuous liner surface.

C. Any damage to the airside surface must be repaired by coating with duct liner adhesive.

3.08 DUCTWORK LEAKAGE TESTING

A. Provide necessary coordination with the Testing agency to schedule leakage testing. Provide temporary blank-off panels or plugs as required to perform the leakage testing. Temporary panels and plugs shall be removed after leakage testing is completed.

B. Correct any leaking joints or assemblies as required to comply with the leakage testing requirements.

C. Ductwork shall not be covered with insulation until compliance with the leakage test requirements have been met.

END OF SECTION

SECTION 23 34 00
FANS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the miscellaneous fan requirements.

1.02 RELATED SECTIONS

A. Section 23 00 10 General Provisions HVAC

B. Section 23 01 00 Operation and Maintenance of HVAC Systems

C. Section 23 05 00 Common Work Results for HVAC

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide data on fan performance including, but not limited to, airflow and total static pressure, and fan motor horsepower.

C. Provide shop drawing showing unit dimensions, weight, electrical requirements, service access requirements, and duct connection sizes and locations.

D. Provide manufacturer's instructions; indicate installation and support requirements.

E. Provide operation and maintenance procedures; include start-up instructions, assembly drawings, and parts list.

1.04 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 211 and AMCA 311. Axijet Fan sizes 1825 and larger bear the AMCA Seal for Sound and Air Performance.

B. Classification for Spark Resistant Construction: Conform to AMCA 99.

C. Each fan shall be tested before shipping. Motors to be tested for amperage drawn.

D. If inverter duty motors are required, see Section 23 05 00 Common Work Results for HVAC for grounding ring requirements.

E. A certificate to be supplied with each fan as to quality control before shipping and compliance to specifications.

F. References:

AMCA 99	Standards Handbook.
AMCA 210	Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
AMCA 211	Certified Ratings Program – Product Rating for Fan Air Performance.
AMCA 300	Reverberant Room Method for Sound Testing of Fans.
AMCA 311	Certified Ratings Program – Product Rating for Fan Sound Performance.
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings.
AMCA 204	Balance Quality and Vibration Levels for Fans.
AMCA 500	Laboratory Methods of Testing Louvers and Dampers for Rating.

PART 2 PRODUCTS

2.01 CEILING FANS

A. Fans shall be UL listed ceiling type with high efficiency direct drive motor.

B. Fan sound at max speed shall not exceed 49 dBA at selection point.

C. Provide with relay for fire alarm shut down.

D. Fan shall be Greenheck HVLS model DS-12 or Big Ass Essence ceiling fan.

2.02 HOODED PROPELLER ROOF FANS

A. Fan hood and base construction shall be galvanized steel. Hood panels shall be arched with interlocking ribs and a low style fan base. Hood support angles shall be heavy gauge galvanized steel. Birdscreens of ½″ galvanized mesh shall be horizontally mounted in the discharge perimeter of the hood.

B. Propellers shall be constructed with fabricated aluminum blades and hubs. Propellers shall be securely attached to fan shafts. All propellers shall be statically and dynamically balanced.

C. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase, and enclosure.

D. Drive frame and panel assemblies shall be galvanized steel. Drive frames shall be formed channels and fan panels shall have a deep-formed inlet venturi. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be fully machined cast iron, keyed and securely attached to propeller and motor shafts. Motor sheaves shall be adjustable for system balancing.

E. The axial exhaust, supply, and filtered supply fans shall bear the AMCA Certified Ratings Seals for both sound and air performance.

F. Provide fan inlet safety, backdraft damper, lifting lugs, curb cap stripping, and extended lubrication lines to exterior of fan base.

G. Fans shall be manufactured by Greenheck, or equivalent by PennBarry or Acme.

PART 3 EXECUTION

3.01 INSTALLATION

A. See drawings for fan scheduled capacities and requirements.

END OF SECTION 23 3400

SECTION 23 37 14
LOUVERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the requirements for louvers.

1.02 RELATED SECTIONS

A. Section 23 05 00 Common Work Results for HVAC

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide data on louver performance including, but not limited to, total static pressure drop verses airflow shown for louver, size, and quantity of louvers required.

C. Provide shop drawing showing dimensions, duct connection sizes, and color charts showing the finishes available.

D. Provide manufacturer's instructions; indicate installation and support requirements.

1.04 QUALITY ASSURANCE

A. Louvers shall be AMCA Standard 500 tested and performance certified.

PART 2 PRODUCTS

2.01 LOUVERS

A. Louver sizes shall be as shown on the drawings.

B. Louvers shall be 6″ deep horizontal stationary extruded aluminum type with drainable blades, channel frame, ½″ mesh aluminum birdscreen, extension sill, and finished in standard gray anodized color; final choice is to be selected by Architect.

C. All intake louvers shall pass a maximum of .01 ounces of water per square foot of area at a face velocity of 400 ft. per minute with an air pressure drop not exceeding 0.15″ of water when tested in a 48″ by 48″ section.

D. Unless otherwise noted, louvers shall be constructed and reinforced for 30 lbs. per square foot wind loading.

E. Louvers shall be Airolite, Arrow United, Construction Specialties, Dowco, Greenheck, Industrial Louvers, Louvers and Dampers, Robertson, or Ruskin.

PART 3 EXECUTION

3.01 INSTALLATION

A. Louver installation shall be as shown on Architectural plans and installed per the manufacturer's instruction and details. per the manufacturer's instructions and details.

END OF SECTION

SECTION 23 81 26

GAS FIRED HEATING EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies requirements for the gas-fired heating equipment.

1.02 RELATED SECTIONS

A. Section 23 00 10 General Provisions HVAC

B. Section 23 01 00 Operation and Maintenance of HVAC Systems

C. Section 23 31 00 Ductwork

1.03 SUBMITTALS

A. See General Conditions for submittal procedure.

B. Provide data on unit performance including, but not limited to, entering air temperatures, airflow and total static pressure, supply fan motor horsepower, total and sensible capacity, applicable AHRI SEER, EER values.

C. Provide shop drawing showing unit dimensions, weight, electrical requirements, service access requirements and duct connection sizes and locations.

D. Provide manufacturer’s instructions, indicate installation and support requirements.

E. Provide operation and maintenance procedures; include start-up instructions, assembly drawings and parts list.

1.04 QUALITY ASSURANCE

A. All unit wiring shall be completely factory installed and shall comply with the requirements of the National Electrical Code.

B. All gas fired furnaces shall be CSA International approved.

PART 2 PRODUCTS

2.01 GAS UNIT HEATERS

A. Unit heaters shall be natural gas fired with baked enamel insulated housing, gravity venting, propeller fan with safety wire guard, aluminized steel burners, and adjustable horizontal discharge louvers.

B. Controls shall be 24 volt with 120 volt power supply, control transformer, appliance pressure regulator, fan limit control, automatic gas valve, limit control, spark ignited intermittent safety pilot with electronic flame supervision and unit mounted adjustable thermostat.

C. Fan motors shall be open drip proof with capacitor start with internal thermal overload.

D. Heater capacity shall be as scheduled on the drawings.

E. Gas Fired Warm air Unit Heaters shall meet or exceed ASHRAE 90.1-2007 Performance Requirements:

All Capacities, Min. Efficiency = 80% combustion efficiency, Ec, per ANSI Z83.8

F. Heaters shall be Reznor, Modine, or Hastings.

PART 3 EXECUTION

3.01 GENERAL

A. The unit heaters, together with all connections, shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SCOPE

A. This section applies to all Sections of Divisions 26 and 28.

B. The general provisions of the contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section and in all sections of this Division.

1.02 WORK INCLUDED

A. Provide all labor, tools, and materials required for a complete and fully operational installation, as described on the drawings or in the specification.

B. The work shall be installed in conformance with NEC Section 110-12, Mechanical Execution of Work, and NECA 1-2006, Standard Practices for Good Workmanship in Electrical Construction (ANSI).

1.03 WORK NOT INCLUDED UNDER DIVISION 26

A. The following items of work are specified under other divisions of the specification:

1. Temporary service for construction.
2. Electric motors.
3. Electric heaters unless otherwise noted on the drawings.
4. Control and interlock wiring for work furnished under other divisions, except where specifically required under this division.
5. Access panels in walls or ceilings.
6. Field finish painting, except for field painting of electrical material with paint supplied by the manufacturer of the material.
7. Starters for certain items of equipment are furnished under other divisions for installation under this division.

B. Refer to other sections of this division for work required in connection with the above items.

1.04 DEFINITIONS

A. “Provide”: furnish and install, complete and ready for operation.

B. “Install”: receive, mount, and connect, complete and ready for operation.

C. “Wiring”: wires and cables installed with all required raceways, connectors, and fittings.

D. “Concealed”: not exposed to view; embedded in masonry or other construction; in furred spaces or above suspended ceilings; below grade.

E. “Exposed”: not concealed; not embedded or installed underground; under raised floors; inside trenches, tunnels, basements, inside built-up HVAC equipment, crawl spaces, and accessible attics.

F. “The Drawings”: that portion of the contract drawings annotated as electrical.

G. “Furnish”: Supply, deliver to job site, protect and store.

1.05 ABBREVIATIONS

A. The abbreviations used on the drawings and in the specification are defined as follows:

1. “AC”: Alternating Current
2. “AFF”: Height above Finished Floor
3. “AIC”: Ampere Interrupting Capacity
4. “AICR”: Ampere Interrupting Current Rating
5. “AHJ”: Authority Having Jurisdiction

6. “NEC”: National Electrical Code
7. “NIC”: Not in the Contract
8. “NF” or “N/F”: Non-fused
9. “30A/2P”: Example of a circuit designation for a 30 Amp 2-Pole fused switch or a 30 Amp 2-Pole circuit breaker or device.
10. “FBO”: Furnished by Others
11. “EC”: Electrical Contractor
12. “EX”: Existing to Remain
13. “EXR”: Existing Relocated - new location indicated on the drawings.
14. “HP”: Horsepower
15. “kVA”: Kilovolt Ampere
16. “kW”: Kilowatt
17. “MCC”: Motor Control Center
18. “MLO”: Main Lugs Only
19. “NTS”: Not to Scale
20. “WP”: Weatherproof

1.06 CODES, RULES, AND REGULATIONS

A. Comply with the following:
   1. Local codes enforced by the local inspection authority.
   2. The edition of the National Electrical Code being enforced for this project by the local inspection authority; NEC 2017.
   3. All applicable laws and ordinances.
   4. The rules and regulations of electric utility company serving the project applicable to the installation of service and metering equipment.
   5. The rules and regulations of the telephone company serving the project applicable to the work required for routing telephone service into the facility.

B. Give all necessary notices, obtain all required permits, and pay all inspection and other fees imposed by Authorities Having Jurisdiction over the work.

1.07 STANDARDS

A. International Building Code (IBC) - 2012 Edition with Georgia Amendments (Georgia State Minimum Standard Building Code).

B. International Fire Code (IFC) - 2012 Edition with Georgia State Amendments (Chapter 120-3-3 - Rules and Regulations for the State Minimum Fire Safety Standards).

C. International Energy Conservation Code (IECC) - 2009 Edition with Georgia Supplements and Amendments.

D. American with Disabilities Act (ADA) with Georgia Amendments Chapter (120-3-20) - Georgia Accessibility Code for Buildings and Facilities).

E. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning (ASHRAE - 90.1).

F. Illumination Engineering Society (IES) - 10th Edition, Reference and Application Handbook.

G. NFPA® - National Fire Protection Association®
   1. NFPA 101: Life Safety Code (LSC) - 2012 Edition with Georgia Amendments.
   2. NFPA 70: National Electrical Code (NEC) - 2014 Edition (No Georgia Amendments).
   3. NFPA 72: National Fire Alarm and Signaling Code - 2013 Edition with 2014 Georgia Amendments.

H. IEC - International Electrotechnical Commission

I. IESNA - Illumination Engineering Society of North America
J. ASTM - American Society for Testing and Materials
K. ANSI - American National Standards Institute
L. IEEE® - Institute of Electrical and Electronic Engineers, Inc.®
M. NEMA® - National Electrical Manufacturers Association®
N. CEA - Insulated Cable Engineers Association
O. UL® - Underwriters Laboratories, Inc.®
P. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance
Q. State of Georgia - Chapter 120-3-3: Rules and Regulations issued by The Safety Fire Commissioner.
R. Comply with the latest editions of standards applicable to the work.

1.08 MATERIALS

A. All material shall be new, and shall comply with the indicated standards.
B. All material shall be UL labeled or UL listed, except where the material is of a type not included in the UL listing service, in which case the material shall comply with other applicable industry standards and the contractor shall provide any examinations or certifications required by the local inspection authority in lieu of UL listing.
C. All material shall be of a suitable type and rating for the intended use, and shall be installed in conformance with the instructions and recommendations of the manufacturer.

1.09 DRAWINGS

A. The drawings are schematic in nature and do not indicate all of the required details of the work. All materials customarily considered to be a part of the electrical work and normally required for a complete and operational installation, shall be provided without additional cost to the Owner.
B. Refer also to the drawings of all other Divisions to coordinate the electrical installation.
C. Equipment of other Divisions is shown schematically on the electrical drawings. Examine the drawings of the Division providing the equipment before roughing in the connections for it. Connect the equipment where actually installed, including wiring through any line voltage controllers, without any additional cost to the Owner.
D. Prior to roughing in circuits for equipment furnished by other trades, and prior to releasing for manufacture, panelboards, starters or motor control centers feeding such equipment, coordinate the electrical provisions being planned with the trade providing the equipment and submit any conflicts in writing.
E. At the direction of the Architect, the location of any electrical outlet, luminaire, or other equipment, may be relocated to a location within 10 feet of the location shown on the drawings at no additional cost to the Owner provided such relocation is made prior to the installation of the outlet, luminaire or equipment being relocated.

1.10 SUBMITTALS

A. Submit shop drawings in the manner and form described elsewhere in the contract.
B. Submittals are required for material as noted in other sections of this Division.
C. Check shop drawings prior to submission and provide date and signature of checker on each item. Note all corrections. Note any requested deviation from the drawings or specification, or if none, then so indicate. The Architect shall return documents without any review, where submitted without prior review by the Contractor.
D. Review of submittals will be only for general conformance with the design concept indicated on the Drawings and in the Specification and for general compliance with the information given in the Contract Documents. Review will be made only of information clearly and specifically indicated in the submittal, and does not imply the acceptability of details, which are not so described in the submittal. Approval of a specific item shall not include approval of an assembly

of which the item is a component. Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the work of all trades; and performing all work in a satisfactory manner.

E. Review of the submittal documents by the Architect does not relieve the Contractor of the responsibility to comply with all requirements of the Contract Documents.

1.11 PROJECT CLOSEOUT

A. Furnish Closeout Documents in the manner and form described elsewhere in the Contract Documents.

B. Closeout Documents shall include the following:

1. Final shop drawings.
2. As-built drawings including redlined as-built field layout and installation drawings.
3. Operation and Maintenance Manuals.
4. Receipts from the Owner stating that he has received satisfactory operational demonstrations and instruction for electrical systems as specified in other Sections.
5. Signed receipts from the Owner for spare parts and materials that are specified to be furnished.
6. Written warranty.
7. All required certifications, including certificate of inspection approval from the code-enforcing Authority.
8. All required test reports (include in Operations and Maintenance Manual).

1.12 AS-BUILT DRAWINGS

A. Provide as-built drawings in the manner and form described elsewhere in the Contract Documents.

B. As-built drawings shall be maintained at the jobsite, and shall be available for review during construction.

C. As-built drawings shall be kept up-to-date and current during the course of construction of the work.

D. Record the final arrangement of the work and exact locations of the work as installed.

E. Provide photographs of buried grounding work prior to backfill of trenches.

1.13 OPERATION AND MAINTENCE MANUALS

A. Provide a minimum of (3) copies of Operation and Maintenance Manuals in the manner and form described elsewhere in the Contract Documents. Manuals shall be typewritten, indexed, tabbed, and loose leaf bound in heavy duty 3-ring binders.

B. Manuals shall include, as a minimum, the following:

1. Operating instructions customized to this specific project
2. Maintenance instructions
3. Parts list
4. Descriptive literature
5. Location, telephone number and contact information of contractors, distributors, dealers and authorized service agents.
6. Test reports and certifications.
7. Record copies of all shop or submittal drawings and data
8. Copies of all software on diskette or compact disk, licensed to the Owner.

C. Maintenance instructions and parts lists shall include the most detailed and advanced publications available from the equipment manufacturer.

D. Demonstrate the operation of the equipment to the Owner, including instruction in its use and operation. Provide instruction by manufacturers representatives where specified in other Sections.

E. Provide Operation and Maintenance Manuals for equipment and systems as specifically described within the Sections of Division 26 - Electrical and Division 28 - Electronic Safety and Security, Fire Detection and Alarm.

1.14 SPARE PARTS

A. Furnish spare parts as specified by the sections in Divisions 26 and 28.

B. Turn over spare parts to Owner designated project representative. Store on site as directed by the Owner. Obtain written receipt detailing specific spare parts turned over and submit this document along with the contract closeout documents.

C. Replace at no cost to the Owner, any spare parts used from the Owner inventory of stock prior to Material Completion or where used for warranty related repairs.

1.15 GENERAL TESTING

A. Test all parts of the work to verify compliance with the Drawings and Specification.

B. Verify correct tightness of all mechanical and electrical connections.

C. Verify integrity of all wiring systems to assure suitable continuity, absence of unintentional grounds, and integrity of required grounds.

D. Perform any required special factory or field-testing as specified in the other Sections of this Division. Provide all wiring, instruments, labor and personnel, required to complete these tests.

E. Where other requirements of this Division require testing in the presence of the Architect, provide at least seven (7) business days advance written notice of such testing to the Architect.

F. Where other requirements of this Division require submission of written records of tests and test results, accumulate and submit all such reports and include as a separate section in the operations and maintenance manuals described elsewhere in this section.

END OF SECTION

SECTION 26 05 01
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL

A. This section covers items of work required by more than one section of Division 26 - Electrical.

B. Refer to other Divisions for requirements pertaining to:
   1. Cutting and repairing
   2. Excavation and backfilling
   3. Concrete
   4. Field painting
   5. Equipment furnished under other Divisions and installed under this Division

PART 2 - PRODUCTS

2.01 CONCRETE INSERTS

A. Manufacturers:
   1. B-Line.
   2. Grinnell.
   3. Hohmann & Barnard.
   4. Kindorf.
   5. Unistrut.

2.02 DRILLED ANCHORS

A. Manufacturers:
   1. Grinnell.
   2. Hilti.
   3. Rawl.
   4. Red-Head.

B. All metal, heavy duty, non-caulking, expansion bolt anchor equivalent to Rawl #9650 Series.

C. Minimum size used shall be ¼” machine thread.

2.03 METAL FRAMING CHANNEL

A. Manufacturers:
   1. B-Line.
   2. Kindorf.
   3. Power-Strut.
   4. Super-Strut.
   5. Unistrut.

B. 1-5/8” x 1-5/8”, 12 Gauge.

C. Use appropriate fittings of same manufacturer.

2.04 BACKBOARDS

A. ¾” thick plywood, A-C grade.

B. Use backboards only in dry locations.

2.05 NAMEPLATES

A. Provide engraved plastic equipment nameplates for all switchboards, panelboards, starters, disconnects, primary selector switches, time clock controls, contactors, and transformers.

B. A circuit nameplate indicating circuit number and the equipment served shall be provided for each new feeder in existing service switchboard and each new branch device in existing power distribution panels.

C. A circuit nameplate indicating circuit number and the equipment served shall be provided for each branch device in new power distribution panels.

D. Distribution equipment nameplates shall state equipment designation, ampere rating, voltage and phase, and “Fed From (Name)”.

E. Nameplates for individually mounted starters, VFD's and safety switches shall state load served, circuit number, voltage and phase.

2.06 FIREPROOFING

A. Manufacturers:
   1. 3-M
   2. Dow Corning
   3. Hilti
   4. Nelson

B. All fireproofing materials shall be the product of one manufacturer and shall be U.L. listed for the type of application where applied.

C. Provide caulk, expanding foam, putty, rigid boards, tape and packing as required by the U.L. listing for the type of penetration being fireproofed.

D. Fireproofing of sleeves, cable trays, troughs, and nipples to be used for low voltage cables shall be indefinitely non-hardening and removable with common hand tools.

E. Fireproofing for penetrations of floor slabs shall also be waterproof for standing water in a non-fire condition.

PART 3 - EXECUTION

3.01 SUPPORTS

A. All work shall be supported from structural elements of the building, except ceiling mounted equipment such as light fixtures, detectors, remote lamps, which shall be supported from ceiling support members independent of ceiling tiles.

B. Size and spacing of supports shall be determined by the load to be supported such that the working load of supports will not exceed a safety factor of 4:1.

C. Spacing intervals of supports shall in no case exceed intervals required by applicable codes.

D. Work under this division shall not be supported from piping, ducts, or work of other trades, unless specifically noted on the drawings or with the written permission of the architect.

E. Drilled anchors in sides of concrete joists shall be at least 3” from bottom of joist in the vertical plane.

F. Provide drilled expansion bolt anchors to support all material mounted on masonry construction.

G. All hardware, nuts, bolts, channel, braces, etc., used on exterior of building shall be galvanized.

H. Rod supports shall be constructed of minimum 3/8” nominal continuously threaded rod of a continuous length. Use of rod couplings to extend the length of hanger rod shall not be allowed.

I. Work installed under Division 26 supported from or attached to structural steel members shall not be welded to steel member but shall be attached by clamping a device manufactured specifically for this purpose.

J. Floor mounted equipment shall be anchored to supporting concrete pad with expansion anchors, minimum ½” nominal stud size.

K. Framework required to support electrical equipment shall be constructed of 1 ½” x 1 ½” steel framing channel bolted together with fittings provided by the framing channel manufacturer.

3.02 BACKBOARDS

A. Unless otherwise noted on the drawings, backboards shall be 8'-0” high by the width shown on the drawings.

B. Painted on all sides with two coats of fire retatdant paint.

C. Attached to supporting structure with 3/8” expansion anchors or toggle bolts with fender washers, placed a maximum of 48” on center, on all sides of backboard.

3.03 CONCRETE

A. Provide 3000 PSI concrete where concrete work is required to support equipment furnished under Division 26, such as for equipment pads, lighting standard bases, and concrete-encased duct banks. Refer to drawings and other sections for locations where concrete is required.

B. Exposed surfaces of concrete placed under this section shall be hand rubbed and all edges shall have 1” chamfer.

3.04 EQUIPMENT PADS

A. Provide 4” high concrete pads for all floor mounted electrical distribution equipment, and elsewhere as specifically noted on the drawings.

B. Anchor equipment in accordance with seismic study.

3.05 EQUIPMENT OF OTHER TRADES

A. Provide all power wiring and connections for all electrically operated equipment. Power wiring includes wiring through any line voltage control devices, such as thermostats and manual starters.

B. Phase connections of motors shall provide proper motor shaft rotation.

3.06 EQUIPMENT CONNECTIONS

A. Connections to motors, transformers, duct heaters and other vibrating equipment shall be made with a short length of flexible conduit, minimum 18”, installed in a manner to permit movement of equipment.

B. For floor-mounted equipment, which is fed overhead and not located adjacent to a wall or column, provide a rigid conduit standpipe from floor to ceiling with a floor flange. Provide appropriate cast conduit “tee” fitting in standpipe for connection of equipment.

3.07 MISCELLANEOUS WORK

A. Provide excavating, backfilling, cutting and repairing required for work included in this division.

B. Protect work from damage and from entry of concrete, moisture, and other foreign material.

3.08 FIREPROOFING

A. All penetrations of fire rated walls, slabs, partitions, and ceilings shall be fireproofed with a U.L. listed system that will maintain the original fire rating of the penetrated structure.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SCOPE

A. This section covers:
   1. Building Wire
   2. Wiring Connectors and Connections.

1.02 QUALITY ASSURANCE

A. All wire and cable shall be delivered to the jobsite in original unbroken packages, cartons or reels, with the manufacturer's name, UL label, and characteristics of the product plainly visible.

B. Wire or cable with defective or damaged insulation or jackets shall not be installed. Where damage, such as cuts, gouges, or slices, is discovered in the insulation or jacket while being installed, the damaged wire or cable shall be removed, and replaced. Field taping or other repair of damaged wire or cable is not acceptable.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

A. Conductors:
   1. Material: 600V copper, 98% conductivity.
   2. Construction:
      a. AWG 10 and AWG 12: solid
      b. AWG 8 and larger: stranded unless otherwise detailed on the drawings.
      c. AWG 14 and smaller: stranded (control use only).

B. Insulation:
   1. Type THWN/THHN-2, dual-rated.
   2. Type XHHW: for underground secondary service entrance.
   3. Type SFF: for wiring inside of luminaries.
   4. Type SIS: for control wiring inside switchboards

C. Voltage Rating: 600V.

D. Color Coding:
   1. Unless contrary to requirements of local codes, the following color code shall apply:

	120/208V	277/480v
Phase A	black	brown
Phase B	red	orange
Phase C	blue	yellow
Neutral	white	gray
Ground	green	green

   2. Color-coding of branch circuit neutral conductors: Where multiple branch circuit conductors of different phases, each with an associated neutral conductor, are installed within the same conduit, provide color coding of each neutral to match the associated phase conductor.
   3. If local codes require other than these color codes to be used, the local codes shall be complied with.
   4. Color code shall be indicated by insulation color (phase, neutral, and ground conductors).
      a. AWG #10 and smaller: insulation color

b. AWG #8 and larger: colored tape applied at all terminations, and junction boxes, pull boxes and manholes.
c. Ground conductors shall be color coded along entire length where visible inside boxes and equipment.

E. Accepted Manufacturers:
1. Belden
2. Encore
3. General Cable
4. Pirelli
5. Rome
6. Southwire
7. American Insulated Wire Corp
8. All wire shall be manufactured in the USA.

2.02 600 VOLT ACCESSORIES

A. Conduit wedges: 0-Z/Gedney Type “S”

B. Terminations, power connections, splices, taps:
1. Splices: Compression type, copper, insulated with heat shrink sleeves.
2. Taps #8 and larger: Compression type copper or copper alloy with snap-on insulation cover designed for the specific tap. Insulation displacement type fittings are not acceptable.
3. Taps #10 and #12: twist-on insulated spring type connectors (i.e., Buchanan B-4) or squeeze-on insulated connector (i.e. 3M #560)
4. Terminations: feeder cable to bus bar: copper or copper alloy compression lug, two bolt hole tongue if mounting space allows.
5. Terminations: feeder cable to device or other condition where compression lugs mechanically will not fit: copper alloy mechanical lug, T&B “Locktite” series.
6. Manufacturers:
a. Burndy
b. 0-Z/Gedney
c. T&B
d. Illsco
e. Square D
f. Panduit
g. Buchanan
h. 3M
i. Ideal

C. Terminations: Control Conductors:
1. Compression Lug: insulated, T & B “StaKonâ” or equal
2. Terminal Strip: barrier style, screw type, suitable for wire size and voltage applied.

D. Wire Lubricants:
1. Lubricant used shall be certified by conductor manufacturer to be satisfactory for use with the specific conductor insulation.
2. Approved material:
a. Ideal “Yellow 77”
b. Ideal “Yellow 77 Plus”
c. 3M wire pulling lubricant

E. Wire markers: Permanent, machine printed, self-laminating vinyl, T & B Type “WSC”, Burndy Type “XC”.

F. Feeder Identification Labels: Engraved black color laminated plate attached to conductors with nylon tie, or T & B TY-553M marked with WT-163M-1 pen.

PART 3 - EXECUTION

3.01 SIZES, QUANTITIES, TYPES

A. Building Wire:

1. AWG 12 minimum.
2. 120 Volt circuits with homerun length over 100 feet shall have AWG 10 minimum homerun conductors.
3. 277 Volt circuits with homerun length over 200 feet shall have AWG 10 minimum homerun conductors.
4. All circuits shall be installed as shown on the drawings. Combining of circuits or homeruns into a single conduit is not permissible except where specifically indicated.
5. Type THHN/THWN-2 shall be used for all branch circuits, AWG 12 through AWG 8.
6. Conductors larger than AWG 8 installed above grade shall be Type THHN-2 or THWN. Where installed in conduit run below grade, shall be type THWN or XHHW.
7. Where branch circuit conductors enter the wiring compartment of lighting fixtures, the insulation used on that segment of the branch circuit shall be UL listed for application at the temperature that will be encountered in the fixture.
8. General-purpose control conductors: AWG 14 minimum, stranded, protected by control circuit overcurrent protection rated not greater than or set at the rated ampacity of the conductor.

B. Flexible Cords:

1. AWG 16 minimum
2. Rated for the applied voltage and load
3. Contain full size ground conductor

3.02 INSTALLATION

A. Building Wire:

1. Conductors shall not be pulled in an ambient temperature lower than 15º F.
2. Adequate wire lubricants shall be used to minimize pulling tension.
3. Conductors shall not be bent, either manually or with bending tools, in a manner that puts excessive stress on insulation or causes it to buckle. Avoid bending to a radius less than manufacturers recommended minimum. Conductors with visibly damaged insulation shall be replaced at no additional cost to the Owner.
4. Conductors installed in vertical raceways shall be supported by wedge fittings attached to the conduit on intervals as prescribed by code. Provide suitable sized pull box enclosures as required to contain the support wedges.
5. All terminations of feeder conductors not made directly on device terminals shall be made with compression lugs installed in accordance with the manufacturers instructions and with a compression tool approved for the terminator used.
6. Feeder conductors shall be individually identified at each end and at all intermediate pull boxes and other accessible locations with feeder designation, source, load, voltage, and phase.
7. General-purpose control conductors and all special systems conductors shall be identified on each end with a unique number or designation. This identification shall be recorded on the contractor's as-built drawings.

B. Flexible Cords: Shall be installed with cord grip and strain-relief connectors.

3.03 TESTS

A. Cable Test:

1. Megger test all feeders.
2. Megger test of all feeders shall be accomplished before energizing circuits. Test shall be phase to phase and phase to ground.
3. Submit a written tabulation of the results of each test to the Owner's representative for review. Replace any cable with installed insulation resistance of less than accepted industry standards.

B. Replacement of Conductors

1. Replace conductors, determined by testing as not acceptable, without additional cost to the Owner.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Grounding System: Grounding of electrical equipment and raceways.

B. Buried Grounds: buried ground radials and driven ground rods as indicated on the Drawings.

C. Miscellaneous grounding, installation of separate ground bus bars and miscellaneous bonding.

PART 2 - PRODUCTS

2.01 BUILDING GROUNDING SYSTEM

A. Raceways for separate ground conductors:

1. Underground: Type PVC, Schedule 40 conduit.
2. All other locations: Aluminum conduit or IMC with bond bushing at each termination.

B. Conductors:

1. 98% conductivity copper, solid or stranded, sizes and types as indicated on the drawings.
2. In general, main and buried buried ground conductors shall be bare copper, AWG 3/0, seven-strand.

C. Connections:

1. Underground or exterior connections shall be exothermic weld between conductors, and between conductors and ground rods.
2. In locations where conductor connects to main structural steel components, exothermic welds shall be used. For connections to light-gauge metals or in other locations where a lug must be used, a 2-hole lug shall be exothermic welded to the grounding conductor.
3. Lugs shall be 2-bolt tongue, compression type.
4. Compression Splices and Taps: Tin plated copper.
5. Water pipe clamps, fence posts: T&B 3900 series or Burndy Type “GAR” Series, cast bronze.
6. Exothermic welds: Cadweld, Thermaweld or Ultraweld.
7. Solid conductor to equipment or bus: Exothermic weld lug bolted to equipment.
8. Flexible copper grounding and bonding jumpers: 0-Z/Gedney Type “FB” series, or Burndy Type “B” Series, rated 190 AMPS, length as required for each application.
9. Ground Rods: “Copperweld”, copper clad steel, ¾ “ diameter, 10' length. Provide sectional rods of same construction where lengths greater than 10 feet are required to be used.

D. Non-Oxide Compound:

1. “NO OXID A” compound as manufactured by Sanchem Chemical Company, Chicago Illinois.

PART 3 - EXECUTION

3.01 BURIED GROUNDS

A. Unless otherwise indicated, ground rods shall be driven into undisturbed earth.

B. Tops of rods and all horizontal buried conductors shall be minimum 30” below finished grade.

C. Minimum lateral distance from building footings shall be 24”.

D. Installed grounding work below grade shall not be covered until reviewed by the Owner's designated representative.

3.02 EQUIPMENT GROUNDING CONDUCTORS

A. Separate Grounding Conductor: All branch circuits and feeders operating at higher than 50 volts to ground shall have an insulated equipment ground conductor, green color, sized in accordance with the National Electrical Code.

B. Raceway Grounds: Other circuits shall utilize the raceway as the equipment ground conductor except where noted otherwise.

C. Single grounding conductors, or RNC conduits containing single ground conductors, shall not be totally encircled by ferrous metal. Use nylon bolts in pipe hangers or in Unistrut conduit straps.

D. All grounding connections shall be subject to inspection and review by the testing contractor and the Consultant. Provide 72 hours advance notice for scheduling review.

E. Provide specified “non-oxide” compound between mating surfaces on all equipment bonding connections where mechanical connections are utilized in lieu of exothermic welds.

F. Ground conductors shall be installed using long radius bends, minimum 12” radius, and shall maintain a downward or horizontal direction. U-bends or tight radius bends less than 90 degrees are not acceptable.

G. All connections to the buried ground ring conductor shall be exothermic welded including connections to ground rods.

H. Bond connections to equipment shall utilize exothermic weld lugs, 2-bolt tongue type, attached using machine screw thread type bolts where exothermic welds cannot, or should not, be utilized.

I. Provide combination “Do Not Disconnect” and “Destination” tags at all interior bonding and grounding connections. Tags shall be green plastic laminate with white letters. Letters shall be minimum ¼” high. Attach all tags using Nylon cable Ty-raps.

3.03 GROUND TESTING

A. Testing of grounding systems and made ground electrodes shall be performed by an Owner approved testing company.

B. Measurements shall include the earth resistivity and resistance of the grounding electrode system.

C. Test the system prior to making modifications.

D. Test the system upon installation/completion of new work incorporating modifications and additions.

E. Make measurements using the "Fall-of-Potential" Method.

F. Ground resistance shall be measured at the transformer and service entrance.

G. Record ambient temperature; date; time; condition of soil (wet or dry). Where available, record approximate water table level (as obtained from local geologists, special core drilling is not required); type of earth materials; earth resistivity.

H. Provide written record of resistance readings and all other information listed above. Include on “Record Drawings”.

I. Any grounding resistance test with less than 25ohms (per NEC) shall not be acceptable.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment 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 34 - Conduit: Additional support and attachment requirements for conduits.

C. Section 26 05 36 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

D. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

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 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 the contract documents. Obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 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 electrical 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 _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. 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.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the 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, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. 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 the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

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 according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION

SECTION 26 05 34
CONDUIT

PART 1 - GENERAL

1.01 GENERAL

A. This section describes conduit and related fittings. Other raceway types are specified in other sections.

1.02 SIZE

A. Minimum conduit size shall be 3/4”; Exception: 3/8” flexible metal conduit or Type AC or MC is permitted for flexible connections to lighting fixtures and fire alarm devices in lengths not to exceed three feet.

B. Conduit size may be increased to facilitate pulling of conductors.

1.03 COORDINATION WITH WORK OF OTHER TRADES

A. Coordinate the conduit layout with the work of other trades. Conduits shall be located to avoid interference with equipment that requires access, maintenance, adjustment, or repair. Conduits shall not restrict the required working clearance around such equipment.

B. Conduits feeding, or connecting to, equipment provided by other trades shall not be installed until such equipment is installed or until the trade providing the equipment furnishes specific rough-in instructions.

C. Conduits shall be concealed, unless otherwise indicated.

1.04 SCOPE OF CONDUIT WORK SHOWN ON THE DRAWINGS

A. The conduit layout indicated on the drawings is schematic and is not intended to show the exact location of conduits unless specifically dimensioned. Locate conduit as required by the architectural and structural details of construction and by the coordination with the work of other trades.

B. Provide all fittings, offsets, supports, pullboxes and other components of the conduit system as required for a complete raceway system.

1.05 QUALITY ASSURANCE

A. The conduit shall be new, of uniform quality and appearance, and marked with U.L. listing and name of manufacturer.

B. All seams shall be smooth, without splits, clean, and with threads protected when delivered to or stored on site.

C. Provide fittings designed and U.L. listed for use with the specific wiring method used.

PART 2 - PRODUCTS

2.01 RIGID METAL CONDUIT (TYPE RMC)

A. Manufacturers:

1. Allied Tube & Conduit Corp.
2. Jones & Laughlin
3. Pittsburgh-Standard
4. Republic
5. Triangle Wire & Cable, Inc.
6. Wheatland Tube Co.
7. Youngstown
8. ETP
9. Robroy Industries, Inc.

B. Material: Full weight, steel, standard size, hot dipped galvanized outside, galvanized or coated inside, threaded ends.

C. Fittings:
   1. Couplings: Continuous threaded, furnished by the manufacturer with conduit. For IMC, ETP “Uni-Swivel” couplings are acceptable.
   2. Threaded joint compound: Fel-Pro C5A.
   3. Terminations (dry locations): Double locknuts with insulated throat, metallic grounding bushing, 0-Z/Gedney type “BLG”.
   4. Terminations (wet locations): Watertight hubs, 0-Z/Gedney Type “CHM”, or conduit hubs integral with equipment.

2.02 INTERMEDIATE METAL CONDUIT (TYPE IMC)

A. Manufacturers: same as for RMC
B. Material: Lightweight steel, standard size, hot dipped or electro-galvanized zinc outside and galvanized or enamel coated inside, threaded ends.
C. Fittings: same as for RMC

2.03 RIGID NON-METALLIC CONDUIT (TYPE RNC)

A. Manufacturer:
   1. Carlon, Division of Lamson & Sessions Co.
   2. Sedco
   3. Centex, Inc.
   4. Heritage Plastics
   5. Certainteed Corp.
B. Material: PVC Schedule 40, unless otherwise indicated, rated for use with 90ºC conductors.
C. Where PVC being run under slabs, or grade, turns up through the slab, or above grade, the elbow and vertical section of conduit from the elbow to the termination of the conduit shall be RMC, or IMC, as protection against the exposed conduit being damaged.
D. Accessories: Fittings, couplings, cement, and other accessories shall be of the same manufacture as the PVC conduit that they are used with.

2.04 ELECTRICAL METALLIC TUBING (TYPE EMT)

A. Manufacture: same as for RMC.
B. Material: Thin-wall steel, galvanized outside, coated inside.
C. Fittings:
   1. For EMT (Sizes 1.25” and smaller):
      a. Couplings: All steel, compression or set-screw type, concrete tight where installed in concrete, Raco, T&B, Midwest, or Steel City, O-Z/Gedney
      b. Connectors: All steel, compression or set-screw type, with nylon throat; Raco, T&B, Midwest, or Steel City.
   2. For EMT (Sizes 1.50” and larger):
      a. Couplings: All steel, compression or set-screw type, of same manufacture.
      b. Connectors: All steel, compression or set-screw type, of same manufacture, and insulated throat, metallic grounding bushing, 0-Z/Gedney Type “BLG”.

2.05 FLEXIBLE METAL CONDUIT (TYPE FMC)

A. Manufacture:
   1. AFC Cable Systems, Inc.
   2. Alflex
   3. Electri-Flex Co.
   4. Steelflex Electro Corp.
B. Material: galvanized steel, Continuous single interlocking strip.

C. Fittings: T&B “Tite-Bite” series, Midwest Fittings.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (TYPE LFMC)

A. Manufacture: same as for FMC.

B. Material: Flexible metallic conduit with PVC jacket, type “UA”, with integral copper grounding conductor suitable for use as equipment grounding conductor.

C. Fittings:

1. Material: Steel, or malleable iron, liquid-tight connector with insulating throat liner (use bushing above 1.25”).
2. Manufacture: T&B, Midwest Fittings, O-Z/Gedney.

2.07 EXPANSION FITTINGS AND ACCESSORIES

A. Expansion fittings:

1. For conduit not embedded in concrete while passing across building expansion joint, provide 0-Z/Gedney type AX for GRC and IMC or type TX for EMT. Provide bonding jumper.
2. For conduit embedded in concrete while passing across building expansion joint, provide 0-Z/Gedney type DX expansion joint or type AXDX if required by the degree of expansion possible.

B. Seals for exterior wall below grade penetrations:

1. Cast-in-place type: 0-Z/Gedney Type “WSK”.
2. Cored openings: 0-Z/Gedney Type “CSMI” and Type “CSMC”.
3. Non-shrink grout where indicated on the drawings and where acceptable to the Architect.

C. Conduit bodies:

1. Used for pulling conductors: Crouse-Hinds LBD series through 2.00” and LBNEC Series 2.50” and above.
2. Used for motor connection: Crouse-Hinds condulet “T” series.

D. Pull strings for empty conduits shall be equal to Greenlee 430 poly pull line.

PART 3 - EXECUTION

3.01 GENERAL

A. Run exposed conduits parallel or perpendicular to structural elements.

B. Two or more raceways run together shall be installed on trapeze type gang hangers. Such raceways assemblies shall be run parallel or perpendicular to structural elements.

C. Where bends are made in a rack of exposed conduits, field bent concentric elbows shall be used.

D. All wiring shall be installed in conduit, unless plenum rated cable is specified in other sections to be installed without conduit or, unless the wiring is shown to be in a wireway or cable tray.

E. Unless specifically noted on the drawings all raceways shall be concealed in walls, floor slabs, topping slab on floor, or in ceiling plenums.

F. Apply threaded joint compound on all Type RMC and Type IMC threaded joint connections.

3.02 SCHEDULE

A. Unless otherwise required, provide RMC or IMC for the following applications:

1. Exposed stub-ups from floor.
2. In poured concrete walls and columns.
3. Where subject to damage.
4. Exposed on exterior of building.
5. Exterior circuits under roadways.

6. Feeder or service conduits under slab, or in grade, where concrete encased RNC PVC is not used.

B. Provide EMT in dry locations only for the following applications:
   1. Concealed work in slabs, walls, and ceiling plenums.
   2. Branch circuit feeder wiring not otherwise required to be run in RMC or IMC.
   3. Signal or communication raceways (other than underground)

C. Provide RNC PVC for the following applications:
   1. Concrete encased duct banks where specifically indicated.
   2. Concealed in or under slab.
   3. Concealed in masonry wall.
   4. Underground single grounding conductors.

D. Flexible conduit is permitted only where concealed above suspended ceilings for connections of light fixtures, tele-power poles, and similar equipment and shall not exceed 3'-0” length. Luminary fixture whips may be 6'0” in length.

E. Liquid-tight flexible metal conduit (LFMC) shall be used for all connections to vibrating equipment, such as motors and transformers, and where flexible conduit is indicated on the drawings, except as noted above. Use Type FMC in plenum spaces.

3.03 INSTALLATION

A. Conduits embedded in slabs shall have a minimum of 1” cover of concrete on all sides. Outside diameter of conduit shall not exceed 1/3 of the slab thickness and shall not be larger than 1.25”.

B. All threaded conduits shall be terminated with specified bushings.

C. Paint all underground steel conduits with one coat of Rustoleum 5269 primer and one coat of Rustoleum 5282 acrylic industrial enamel. Touch up all wrench marks and other defects.

D. Underground conduits shall be a minimum of 24” below final grade.

E. Conduit joints:
   1. Ream end of conduit smooth.
   2. Conduit ends shall meet in coupling.
   3. Provide unions where required, of the Erickson Type.
   4. Provide joint compound on the male threads of RMC and IMC conduit.

F. Use double locknuts at threaded conduit terminations.

G. The conduit system shall be left free of all debris, water and foreign material. Plug or cap all conduits with exposed ends to prevent entrance of concrete or other foreign material. Pull a cleaning swab through all conduits prior to pulling conductors.

H. Conduits run parallel to, or crossing hot pipes, shall not be closer than 0'-6” to hot pipe.

I. Anchors or supports in waterproof walls shall be of the type and methodology directed by the architect.

J. Empty EMT raceways shall be terminated with connectors, and if over 1.25”, specified bushings.

K. Raceways in accessible ceiling plenums shall not be installed closer than 8” to ceiling.

L. Groups of two or more conduits turned out of a slab shall be neatly arranged parallel to the adjacent wall and evenly spaced with at least (1) inch separation.

M. Conduit passing through walls below grade shall be run through specified fittings in the wall and shall be sealed to be waterproof.

N. All threaded joints in rigid conduit shall have pipe compound applied to the male thread only, to be watertight where buried below grade and not encased in concrete.

O. Slope duct away from building entrances.

3.04 ACCESSORIES

A. Pull wires: provide nylon pull wire in all empty conduits and at all data and telephone outlet locations.

B. Expansion fittings: provide at all building expansion joints.

C. Fire seals: provide where conduit passes through a floor slab (other than slab on grade) and where conduit passes through fire-rated masonry walls, unless cast in place.

D. Install specified seals for exterior wall below grade for penetrations of conduits.

3.05 IDENTIFICATION

A. All exposed conduits 2 inches and larger shall be identified with markers 20 feet on center.

B. Conduit for fire alarm system shall be marked red a minimum of every ten feet.

END OF SECTION

SECTION 26 05 35
BOXES

PART 1 - GENERAL

1.01 SCOPE

A. This section covers pull boxes, outlet boxes, and junction boxes.

B. Refer to Section 26 27 26 - Wiring Devices and to Section 27 10 00 - Structured Cabling for additional requirements for outlet boxes for wiring devices.

1.02 APPLICATIONS

A. All splices, pull boxes, taps, connections, devices, etc., shall be installed using boxes of the appropriate type, designed and approved for the intended purpose.

PART 2 - PRODUCTS

2.01 GENERAL

A. Box sizes specified are minimum, and shall be increased where required by code due to the number of conduit entries, conductors, devices, or taps in the box.

B. All boxes shall be made of galvanized sheet steel, of code gauge thickness, but no less than 1/16” thick or 14 Gauge.

C. Outlet box covers shall be attached by means of machine screws. Self-tapping sheet metal screws are not acceptable.

2.02 MANUFACTURE

A. Outlet boxes: Steel City, Appleton, Raco

B. Cast boxes: Crouse-Hinds, Appleton

2.03 SCHEDULE

A. Schedule indicates box type; select actual box and plaster ring to suit actual conditions:

		BOX	COVER
1.			
2.	Recessed device outlet	RACO 683	RACO 770
3.	Recessed tele/data outlet	RACO 683	RACO 770
4.	Recessed wall mounted fixture	RACO 683	RACO 767
5.	Flush concrete outlet RACO 272	RACO 893	
6.	Flush concrete junction	RACO 272	RACO 892
7.	Junction box above ceiling	RACO 257	RACO 832
8.	Exposed device outlet C/H “FS”	C/H DS32	
9.	Exposed fixture outlet C/H	“GRFX”	
10.	Flush ceiling fixture	RACO 683	RACO 767

2.04 SPECIALTIES

A. Boxes installed in concrete shall be UL listed for such use.

B. Through-wall boxes are not acceptable.

C. Provide 3/8-fixture stud and box supported from structure when required by weight of fixture being supported.

D. Junction boxes installed above ceilings shall be plenum type.

2.05 PULL BOXES AND JUNCTION BOXES

A. In dry locations, boxes shall be galvanized sheet steel, minimum 12 gauge, with machine screw covers, and welded construction. Welds shall be slag-free and cold galvanized.

B. In damp locations or outdoors, unless otherwise shown on the drawings, boxes in steel raceway runs shall be galvanized cast iron, with gasketed covers and conduit hubs, or drilled and tapped. Boxes in Type RNC PVC raceway runs shall be PVC with gasketed cover.

C. All boxes shall be rated for their application, such as sidewalk, or light vehicle traffic.
D. Provide insulated cable support racks in feeder pull boxes where conductor length exceeds 48” inside pullbox.

PART 3 - EXECUTION

3.01 GENERAL

A. Refer to other sections for mounting heights of boxes for devices and equipment.
B. Boxes shall be located clear of other trades, and shall be accessible.
C. Coordinate the exact location of ceiling outlet boxes and boxes concealed above ceilings, with ductwork and piping so that the box will be accessible.
D. All required pull boxes are not indicated on the drawings. Provided boxes as determined by actual field installation and as required for a complete installation.
E. Using a permanent, waterproof, wide black marker, clearly label cover of all branch circuit junction boxes, and smaller pull boxes, with panel and circuit number of circuits contained in, or passing through, the box.
F. Branch circuit and feeder junction and pull boxes used with emergency life-safety feeders and circuits shall be painted red.
G. Provide engraved “lamicore” nameplate on cover of each major feeder pull, or junction, box as specified under Section 26 05 63 - Electrical Identification.

3.02 INSTALLATION

A. Boxes shall be securely anchored in place, and shall be supported independent of the raceway system.
B. Boxes installed in poured concrete shall be anchored to the formwork and protected against entry of any concrete.
C. Boxes shall be set square and plumb with building elements.
D. Outlets for ceiling mount fixtures shall be rigidly supported from the grid or structure with an assembly manufactured for this purpose.

END OF SECTION

SECTION 26 05 43
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL

A. This section covers:
   1. Underground conduit ductbanks.
   2. Ductbank encasement and backfill material.
   3. Fluidized (Flowable) Thermal Concrete (Thermal Resistivity) Requirements.

B. Concrete is specified in another section.

1.02 SUBMITTALS

A. Provide Thermal Resistivity test reports for encasement and backfill materials including dryout curves from 20% to 0% moisture content.

PART 2 - PRODUCTS

2.01 DUCT

A. Duct shall be PVC pipe, U/L labeled for encased or direct burial and for use with 90°C conductors.

B. Duct shall be Carlon, Schedule 40, or Sedco equivalent, unless otherwise indicated on the drawings.

C. Medium voltage duct banks shall be 6 (six) inch diameter schedule 40-Type EB PVC, concrete encased.

2.02 ACCESSORIES

A. All couplings, cement, solvent, spacers, and other accessories shall be of the same manufacture as the duct.

B. Marking tape: Panduit #HTDU-3RE for power

2.03 TERMINATION

A. Under equipment, at manholes, or in pits under equipment the duct bank shall be terminated with bell ends arranged to be flush with the face of the concrete.

B. Where the raceways in the duct bank extend above concrete slabs or are otherwise exposed the exposed raceways shall be GRC or IMC.

2.04 DUCTBANK COVER

A. CONCRETE ENCASEMENT
   1. Ductbanks shall be concrete encased except where located beneath the building floor slab. Ductbanks extending beyond to building shall be concrete encased, beginning 5 ft. within the building perimeter.
   2. All stub-ups shall be concrete encased.
   3. Fluidized (flowable) Thermal Concrete Encasement: Maximum “Thermal Resistivity” (RHO) shall be 90 degree C-cm/W at 5% moisture content.
      a. Provide a minimum of 3” concrete cover over the ducts.
      b. Provide a minimum of 2” concrete between adjacent ducts, or 7.5” on center, or as depicted in ductbank details on the Drawings, whichever is greater.
      c. Provide reinforcing steel running parallel with the ductbank at each corner, extending 10 ft. beyond the edge of traffic pavement. Reinforcing steel shall be #4 rods.

B. BACKFILL
   1. Fluidized (flowable) Thermal Concrete Backfill (or for tested soils backfill): Maximum Thermal Resistivity (RHO) shall be 90 degree C-cm/W at 5% moisture content.

PART 3 - EXECUTION

3.01 GENERAL

A. All PVC ducts shall be installed in strict accordance with the manufacturer's instructions to insure that joints are made up securely and are watertight.

B. The Owner's representative shall be notified before pouring of the concrete encasement so that he may review the installation prior to the pour.

3.02 PROTECTION

A. The ducts shall be protected from damage during installation. Any cracked or damaged pipe or joints shall be replaced before pouring concrete.

3.03 DUCT INSTALLATION

A. Bends in the ducts shall be made using manufacturer-approved bending equipment, using plugs in the ends of the pipe to prevent deformation.

B. Duct entering existing manholes: Field-coordinate exact conduit duct entry location into side of manhole with existing installed work and conditions. Core through vertical side-wall of manhole. Entry location shall allow adequate clearances with existing equipment and cables inside manhole. Cored openings shall be sealed to prevent entry of moisture.

C. Support the pipe in the ductbank using appropriate base spacers and intermediate spacers to maintain proper alignment of and separation between the ducts.

D. Maintain gradual slope along length of ductbank to allow any moisture that enters conduit to drain toward manholes.

E. GRC or IMC stub-ups shall be supported during installation to prevent damage to the PVC duct from the weight of the steel ell.

F. Cement furnished by the duct manufacturer shall be used for all joints in strict accordance with the manufacturer's instructions.

G. Swab inside the ducts clean before pulling conductors.

H. LOCATION

1. Top of ductbank shall be minimum 24 inches below finished grade where located outside of the building, and 8 inches minimum below finished floor slab where located beneath the slab.
2. Install PVC “ELECTRICAL” underground marker tape continuous above the top of all ductbanks at 1 foot below grade. Refer to Section 260563 - Electrical Identification for additional requirements.

END OF SECTION

SECTION 26 05 48
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section outlines requirements for seismic restraints for electrical conduit and equipment.

1.02 STANDARDS

A. International Building Code, current edition.

1.03 SEISMIC DESIGN COMPLIANCE

A. Electrical work shall meet the seismic requirements of the International Building Code, Section 1621.

B. Provide seismic bracing details for miscellaneous equipment, conduits and cable trays. Analysis shall be performed by a firm or manufacturer regularly engaged in seismic analysis. Submit shop drawings.

C. Loading of cable trays and ladders shall be assumed to be 90% of the maximum rated load.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hangers shall be as specified in Section 26 05 01 - Basic Materials and Methods.

B. Obtain materials from an approved manufacturer of seismic restraint equipment.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT REQUIRING RESTRAINTS

A. All the following equipment and raceways located inside the building shall be provided with restraints:

1. Recessed lighting fixtures.
2. Raceways 2½” and larger which are independently supported from the structure.

B. Raceways listed above are not required to be restrained if the hangers are 12” or less in length as measured from the top of the conduit to the bottom of the hanger support.

3.02 SUPPORT REQUIREMENTS

A. Seismic support shall be provided for both transverse and longitudinal restraint.

B. Restraints shall be as supplied by the restraint equipment manufacturer for the specific jobsite condition, installed in accordance with manufacturer's instructions.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Identification nameplates and labels.
B. Wire and cable identification markers.
C. Conduit identification markers

1.02 SUBMITTALS

A. Product Data: Provide catalog data for nameplates, labels, and markers.
B. Manufacturer's application conditions and limitations of use including, instructions for storage, handling, protection, examination, preparation, and installation of product.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Engraved three-layer laminated plastic nameplate with minimum 1/4” height letters.
B. Equipment connected to non-essential supply (commercial power only): White letters on Black background.
C. Locations:
   1. Main Service and Distribution equipment enclosures and over-current devices.
   2. Electrical distribution equipment enclosures.
   3. Transformers
   4. Motor Control Devices and Contactors.
   5. Disconnect switches.
D. Labels:
   1. Locations required:
      a. All motors.
      b. All field equipment fed from 120/208 V power source.
      c. All field equipment such as motors, control stations, etc.
E. Provide engraved plastic equipment nameplates for all panelboards, disconnects, and transformers.
F. Provide engraved plastic equipment nameplates for all panelboards - include voltage, phase, feeder conduit/conductor size, origin of feeder connection and calculated AIC.
G. Nameplate wording shall be coordinated with final equipment identification nomenclature and approved by the owners' designated representative prior to installation.
H. Letter Size:
   1. 1/4 inch letters: Identify individual equipment, and loads.
   2. 1/2 inch letters: Identify major electrical equipment and panelboards.

2.02 WIRE AND CABLE MARKERS

A. Description: Non-ferrous identify tag or shrink type label.
B. Locations: Each cable feeder, power circuit, and conductor in vaults, manholes, gutters, pull boxes, starters, outlet and junction boxes, control panels, panelboards, switchboards, etc., and each load connection.
C. Legend: Each tag or label shall be typewritten with description listed below.
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams.

2.03 CONDUIT MARKERS

A. Location: Furnish vinyl markers for each 2.00” or larger conduit longer than 6 feet for power circuits or Type MC Cable with 3/0 or larger conductors longer than 6 feet.

B. Spacing: Adjacent to each termination at equipment and pull boxes and intermittently at 20 feet on center.

C. Color: Use the following color-coding:

1. 480 volt system: Orange color and black stencil, voltage in 1/2” black letters. At the source end, also indicate the load served in 1/2” black letters. At the load end, also indicate the circuit source identification in 1/2” black letters. At intermediate points, also identify both the circuit identification and load in 1/2” black letters.
2. 208 volt system: White color and black stencil, voltage in 1/2” black letters. At the source end, also indicate the load served in 1/2” black letters. At the load end, also indicate the circuit identification in 1/2” black letters. At intermediate points, also identify both the circuit identification and load in 1/2” black letters.

2.04 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

B. Location: Along length of each underground conduit or direct buried cable or duct bank.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Secure nameplate to inside surface of door on panelboards that are recessed in finished wall locations.

D. Install conduit markers per Section 2.

E. Stencil conduit markers or use adhesive letters or order pre-labeled. Handwritten entries that are neat and legible and not smeared are acceptable. Any conduit markers that that are determined not to be neat, legible, and free from smears shall be replaced to the satisfaction of the Architect.

F. Identify underground conduits and direct buried cables using underground warning tape. Install one tape per trench at 3 inches below finished grade and at 12 inches above top of conduits.

G. Use Scotch +35 marking tape to color-code the phase conductors equal and larger than AWG #6.

H. In a high delta service, the phase with the highest voltage to ground shall be orange.

I. For other conductor color-coding, see Section 26 0519 - Low-Voltage Electrical Power Conductors And Cables.

END OF SECTION

SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Short Circuit Study.
B. Arc Flash Study.
C. Coordination Study and Analysis.

1.02 SCOPE

A. Provide an overcurrent protective device current coordination study in a computer-generated format.
B. From the primary of the service transformer down through the last branch circuit breaker of new equipment installed under this project.
C. Compute short-circuit currents.
D. Arc Flash Study: Perform an arc flash hazard analysis. The analysis shall determine the Flash Protection Boundary (FPB) and the Personal Protective Equipment (PPE) required.

1.03 QUALITY ASSURANCE

A. The Study shall be prepared by a Registered Professional Electrical Engineer experienced in studies of this type and shall bear the PE's seal and signature.
B. Study shall conform to current ANSI/IEEE standards.

1.04 SUBMITTALS

A. Submit prior to release of distribution system equipment for manufacture.
B. Description and version of software program used, including database type libraries.
C. One Line Diagram identifying equipment, busses, and protective devices.
D. Textual description of coordination obtained and compromises selected.
E. Tabulation of all adjustable device settings.
F. Time-current curve plots graphically illustrating protective device ratings and characteristics including:
   1. Utility protective device.
   2. Secondary main protective device.
   3. Each device through, and including, the main and largest branch circuit device in the most downstream panel.
   4. Transformer inrush and damage limits.
   5. Device long-time pick-up and delay, short-time pick-up and delay, instantaneous, ground fault pick-up and delay.
   6. Motor-starting curve.
G. Submit final As-Built version of Study minimum 60 days prior to final review of electrical system.

PART 2 - PRODUCTS

2.01 ARC FLASH LABELS

A. Self adhesive, vinyl.
B. Color based on PPE rating.
C. Include Flash Protection Boundary and the PPE required.

PART 3 - EXECUTION

3.01 SETTINGS

A. Submit report showing final adjusted settings of all protective devices.

B. Set all protective devices in accordance with the study.

C. Install Arc Flash labels on switchboards and panelboards and similar equipment. The marking shall be located so as to be clearly visible to qualified persons.

END OF SECTION

SECTION 26 21 00
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

C. Utility Company charges associated with providing permanent service to be paid by Contractor..

D. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.04 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics:
   1. Service Type: Underground.
   2. Service Voltage: 480Y/277 V, 3 phase, 60 Hz.

C. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Pads: Furnished and installed by Contractor per Utility Company requirements.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.

d. Primary:
   1) Trenching and Backfilling: Provided by Contractor.
   2) Conduits: Furnished and installed by Contractor.
   3) Conductors: Furnished and installed by Utility Company.
e. Secondary:
   1) Trenching and Backfilling: Provided by Contractor.
   2) Conduits: Furnished and installed by Contractor.
   3) Conductors: Furnished and installed by Contractor (Service Point at transformer).

2. Terminations at Service Point: Provided by Utility Company.
3. Metering Provisions:
   a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.

D. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Arrange equipment to provide minimum clearances and required maintenance access.
D. Provide required support and attachment components in accordance with Section 26 05 29.
E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 GENERAL

A. This section describes separately mounted dry-type transformers.

1.02 SUBMITTAL DOCUMENTS

A. Shop drawings: Indicate dimensions, taps, insulation class, K-rating, and connection diagram of windings.

1.03 OPERATION AND MAINTENANCE (O&M) DATA

A. Provide record copy of final submittal documents.

B. Provide manufacturer's published recommended procedures for preventative maintenance and repair.

C. Provide all information bound within the required Division 26 Master O&M manuals specified in another section.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Cutler-Hammer

B. G.E.

C. Siemens

D. Square D

2.02 CONSTRUCTION

A. Dry-type, metal enclosed, self-cooled ventilated type, dead front, drip-proof, copper windings.

B. Primary, secondary and tap connections shall be accessible from the front.

C. Core and coil assembly shall be mounted to the enclosure framework on vibration isolators.

D. Rated for 115º C rise, 220º C insulation system, and 40º C ambient.

E. Two-winding type, three-phase, delta connected primary, grounded wye secondary.

F. Transformer taps:

1. Three-phase, 15 kVA and smaller: (2) 2.5% above and (2) 2.5% below.
2. Three-phase, 30 kVA and larger: (2) 2.5% above and (4) 2.5% below.
3. Single-phase: (2) 2.5% below.

G. Transformers with 120/208 Volt secondary shall be “K-rated” as indicated on the one line drawing.

H. Noise Level: NEMA standard for each range of kVA ratings.

I. Enclosure: NEMA Type 1, except where installation location requires use of an alternate NEMA Type enclosure.

J. Shall meet the latest Department of Energy requirements.

PART 3 - GENERAL

3.01 PROTECTION

A. Protect from moisture and debris entry and from physical damage

B. Dry out transformer windings prior energizing.

3.02 MOUNTING

A. Mount and support in accordance with the manufacturer's recommendations.

B. Provide seismically designed supports and bracing where required by site geographic location and where installed adjacent to essential equipment that could be damaged by potential movement during seismic events.

C. 15kVA and smaller ceiling-hung transformers shall be suspended using 1/2 inch threaded rod, with a suitable size channel iron frame base for supporting the transformer. Small wall-mounted transformers shall utilize manufacturer's wall-mount brackets where wall is suitable for supporting weight of unit.

D. Mount on concrete housecleaning pads on floor, or on wall, or suspended from structural elements as indicated. Anchor floor-mounted units to concrete pad.

E. Provide Mason Type “W” neoprene vibration pads between base of transformer and mounting surface.

3.03 CONNECTIONS

A. Connections shall be made using a short length of flexible metallic conduit, between feeder conduit, and primary disconnect where provided, and enclosure. Use liquid-tight flexible metallic conduit where located in areas suitable for such use.

B. Connect primary phases A, B, C to H1, H2, and H3 in that order. Connect secondary phases A, B, C to X1, X2, and X3 in that order. Color code conductors as described in other sections.

3.04 GROUNDING

A. Provide a grounding electrode conductor (GEC) from the neutral terminal to the building main ground bus bar, to a main structural steel column, to a domestic potable water metallic pipe. Size per NEC, or as indicated on the drawings, and run in Type RNC conduit.

B. Transformer neutral: Bond to the enclosure and frame using a manufactured length of flexible copper wire braid with factory lugs, sized per NEC, or as indicated on the drawings.

END OF SECTION

SECTION 26 24 05
DISTRIBUTION EQUIPMENT TESTING

PART 1 - GENERAL

1.01 DISTRIBUTION EQUIPMENT TESTING

A. All costs incurred for testing shall be included under Division 26.

B. Description of Tests:

1. Preliminary Inspections and Tests: Visual inspections of electrical equipment, wire checks of factory wiring and any other preliminary work required to prevent delays during performance of electrical acceptance tests.
2. Electrical Acceptance Tests: Those inspections and tests required to show that the workmanship, methods, inspections, and materials used in erection and installation of the electrical equipment conforms to accepted engineering practices, IEEE, ICEA and NEMA Standards, the National Electrical Code, National Electric Testing Association (NETA) specifications, and manufacturer's instructions, and to determine that the equipment involved may be energized for operational use.
3. Operating Tests: Tests performed on electrical equipment, installed under other sections, to show that the electrical equipment will perform the functions for which it was designed.
4. Final Acceptance: Final acceptance of electrical equipment will depend on equipment integrity as determined by the electrical acceptance test, and also depend on complete operational tests.

C. Test and calibrate all new circuit breakers furnished under this contract and “spare” breakers scheduled to be placed into service, prior to acceptance of the building. This requirement shall apply to breakers rated 100 amp and larger.

D. Tests shall be conducted per NETA recommendations and in accordance with NETA ATS Standard Practices

E. In general, tests shall include the following:

1. Determine proper operation of circuit breaker trip devices.
2. Determine trip ratings or settings are correctly adjusted.
3. Determine control and interlock devices perform as specified.
4. Determine electrical resistance across contact surfaces in switches, circuit breakers and bus-way are acceptable.
5. Torque all bolted connections.
6. Determine bus bars are properly braced as specified.

F. Contractor shall advise in writing as to when the distribution equipment will be tested so that the Owner may be present to witness this test. At least one week's notice of this test shall be given.

G. These tests shall not alter the contractor's guarantee of the equipment. All work and materials found to be in non-compliance shall be replaced and re-tested by the contractor without additional cost to the Owner.

H. Provide (3) copies of bound test reports, bound and included in the closeout documentation.

END OF SECTION

SECTION 26 24 16
POWER DISTRIBUTION PANELBOARD

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes power distribution panelboard scheduled on the drawings as Main Distribution Panel (MDP).

1.02 SUBMITTAL DOCUMENTS

A. Provide a schedule of each panelboard demonstrating placement of branch breakers in accordance with the schedules on the drawings. Circuit numbering shall be indicated and configured as scheduled.

B. Provide dimensioned drawings of panel can and panel cover detailing construction of hinged front cover trim. Gutter sizes shall be indicated.

C. Provide ratings of each main and branch device, panelboard electrical characteristics, and assembly fault current rating.

1.03 OPERATION AND MAINTENCE MANUALS

A. Provide record copy of submittal documents.

B. Provide maintenance instructions, detailed drawings, and parts lists.

C. Provide manufacturer's published recommended procedures for preventative maintenance, repair, and normal operation of the panelboards and all components.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. Main Panel (MDP):
   1. Service entrance rated and bear UL "SE" label.
   2. Power meter: I-Line Smart Cell "PM5563", power meter with current monitoring of incoming feeder.
   3. Main breaker: Molded-case, electronic trip (LSIG) with adjustable instantaneous. Provide with Shunt Trip accessory and fused voltage source. Shall not plug-in to I-Line bussing.
   4. Internal SPD.
   5. Full Cover, lockable, trim hinged to enclosure.
   6. Nema 3R rated for exterior installation.

B. Panelboards shall be factory assembled with I-Line Type plug-on breakers.

C. Plated copper, 1000 amps per square inch current density.

D. Construction shall be dead front with separately mounted interior trim.

E. Feeder Circuit breakers: Molded-case, electronic trip with adjustable instantaneous.

F. Provide "high-magnetic withstand" type breakers for feeders serving step-down transformer primary side input.

G. Branch breakers shall be numbered and identified as scheduled on the drawings.

H. Multi-pole breakers shall be common trip and shall have lock-out hardware installed.

I. Enclosure shall be galvanized sheet steel. End and side panels of enclosure shall be blank without knockouts.

J. All panels shall have finished door cover trim, hinge mounted to enclosure box. Cover shall be factory painted.

K. Provide flush lock and catch. Lock mechanism shall be metal construction.

L. Gutter sizes:
   1. Manufacturer's standard, unless otherwise noted.

2. Provide additional 8” gutter width with sheet metal barrier where feeder passes through panel can or is tapped in gutter.

M. Provide ground bus bonded to enclosure.

N. Where a panelboard is shown to be fed by more than one conductor per phase, an individual lug shall be provided for each conductor.

O. Provide circuit breaker mounting hardware where a “space” is scheduled.

P. Power panels shall be designed to allow interchangeability of branch devices and shall accommodate mixing of large frame size devices.

Q. Minimum interrupting rating of main and all branch breakers shall be the minimum assembly rating as scheduled on the drawings. Series ratings are not acceptable.

R. Provide internal SPD.

2.02 MANUFACTURERS

A. Square D “I-Line” Series

PART 3 - EXECUTION

3.01 GENERAL

A. Branch circuit conductors shall be run into breakers at right angles to enclosure sides, bundled neatly and laced with nylon ties.

B. Provide all specified engraved nameplates on all branch breakers in power distribution panelboards.

C. Conductors shall not be spliced within the panelboard enclosure. Branch circuit conductors not long enough to reach the scheduled branch circuit breaker shall be replaced.

D. Tighten all factory connections, including breaker mounting hardware prior to energizing panelboard.

E. All unused breaker mounting spaces shall be covered or blanked.

F. Lace up all conductors using nylon Ty-Raps.

3.02 MOUNTING

A. Surface mount panelboards at same height to top of trim, generally 6'-6”, unless height of panel dictates otherwise.

B. Power distribution panelboards shall have bottom of enclosure at minimum 0'8” A.F.F. where total enclosure height is 99” or greater. Where gypsum board walls are encountered at mounting locations, provide metal framing channel installed to transfer weight of panel to floor. Provide bracing to wall.

END OF SECTION

SECTION 26 24 17
BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes panelboards as scheduled on the drawings as “Panelboards” and also referred to on the drawings and in the specification as “panel”.

1.02 SUBMITTAL DOCUMENTS

A. Provide a schedule of each panelboard demonstrating placement of branch breakers in accordance with the schedules on the drawings. Circuit numbering shall be indicated and configured as scheduled.

B. Provide dimensioned drawings of panel can and panel cover detailing construction of hinged front cover. Gutter sizes shall be indicated.

C. Provide ratings of each main and branch device, panelboard electrical characteristics, and assembly fault current rating.

1.03 OPERATION AND MAINTENCE MANUALS

A. Provide record copy of submittal documents.

B. Provide maintenance instructions, detailed drawings, and parts lists.

C. Provide manufacturer's published recommended procedures for preventative maintenance, repair, and normal operation of the panelboards and all components.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. Lighting and branch circuit panels shall be factory assembled with bolt-on breakers.

B. Bus shall be plated copper.

C. Construction shall be dead front with separately mounted interior trim.

D. Branch breakers shall be arranged as scheduled on the drawings.

E. Multi-pole breakers shall be common trip. Tandem breakers shall not be furnished.

F. Enclosure shall be galvanized sheet steel. End panelboards shall be blank without knockouts.

G. All panels shall have hinged door-in-door trim. Factory paint cover with two coats of a standard gray color enamel.

H. Provide flush lock and catch. Lock mechanism shall be metal construction.

I. Gutter sizes:

1. Manufacturers standard, unless otherwise required.
2. Provide additional 8” gutter width with sheet metal barrier where feeder passes through panel can or is tapped in gutter.

J. Provide ground bus bonded to enclosure.

K. Where a panelboard is shown to be fed by more than one conductor per phase, an individual lug shall be provided for each conductor.

L. Provide circuit breaker mounting hardware where a “space” is scheduled.

M. Minimum interrupting rating of main and all breakers shall be the minimum assembly rating as scheduled on the drawings. Series ratings are not acceptable.

N. Provide drip hood option.

2.02 MANUFACTURERS

A. Cutler-Hammer

B. General Electric

C. Siemens

D. Square D

PART 3 - EXECUTION

3.01 GENERAL

A. For all flush mounted panelboards provide (6) six ¾" empty conduits stubbed out at top of wall from panel.

B. Branch circuit conductors shall be run at right angles to enclosure sides, bundled neatly and laced with nylon Ty-Raps.

C. Provide typewritten panel directories indicating location and type of load served by each branch circuit. At the top of the directory, type in bold letters the location in the building of the breaker which feeds the panelboard. Indicate all deletions and additions and provide date of change on the directory. The panel directory must reflect the actual room numbers.

D. Conductors shall not be spliced within the panelboard enclosure. Branch circuit conductors not long enough to reach the scheduled branch circuit breaker shall be replaced.

E. Tighten all factory connections, including breaker mounting hardware prior to energizing panelboard.

F. All unused breaker mounting spaces shall be covered or blanked.

G. Provide specified nameplate on panel front cover.

3.02 MOUNTING

A. Surface mount or flush mount, at locations as indicated on the drawings, at same height to top of trim, generally 6'-6", unless otherwise required by specific site conditions.

B. Mount flush panelboards in accurately cut openings, with face of can flush with face of wall.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE

A. This section describes wall switches, occupancy sensors, receptacles, faceplates, and other wiring devices.

B. Outlet boxes are specified in another section.

1.02 STANDARDS

A. All devices shall be UL labeled.

B. All devices shall meet applicable NEMA wiring device standards.

C. All special-purpose receptacles shall be NEMA Standard configuration.

1.03 SUBMITTAL DOCUMENTS

A. Submit manufacturer catalog cut sheets of wiring devices specified in this section.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Provide record copy of device submittal incorporated into the project O&M Manuals.

PART 2 - PRODUCTS

2.01 MANUFACTURE

A. Switches, receptacles, plates:

1. Arrow-Hart
2. Bryant
3. Hubbell
4. P&S/Legrand

B. Occupancy Sensors

1. Wall Mounted: passive infrared sensor; suitable for single or multi-gang mounting in standard depth wall box.
2. Ceiling Mounted: passive infrared, ultrasonic type, or dual technology type sensor, suitable for mounting at ceiling height in suitable outlet box.
3. Manufacturer: The Watt Stopper, Inc. or equivalent by Sensorswitch, Cooper Greengate, or Hubbell..
4. Device types and manufacturer series numbers on the drawings are based on The Watt Stopper, Inc.

2.02 DESCRIPTION

A. The color of all devices shall be selected by the Architect.

B. Switches, receptacles:

1. Standard wall toggle switches for lighting circuits shall be specification grade commercial, 20 Amp, AC only, nylon, quiet type, with ground bonding screw terminal, Hubbell #1221 Series, back wired using screw and clamp.
2. Duplex receptacles shall be commercial specification grade 125 volt, 20 amp, 3-wire grounding, nylon face, with self-grounding attachment, with ground bonding screw terminal, Hubbell #5242 Series, back wired using screw and clamp.
3. Individual duplex receptacles on separate 20 Amp circuits shall be rated 20 Amp.
4. Special purpose receptacles shall be of NEMA type indicated, heavy-duty, with nylon face where available.
5. G.F.C.I. Type receptacles shall be rated 20 Amp, Hubbell #GF20 Series.

C. Device plates/covers for interior application: Stainless steel, Hubbell Series; or approved by Architect.

D. Device plates/covers for exterior exposed outlets:

1. Weatherproof, heavy-duty cast aluminum, “in-use” type where required by the location to be applied, Hubbell #WPxxx Series, or cast iron for FS/FD box mounting.
2. Weatherproof receptacle covers shall be suitable for the specific application.

PART 3 - EXECUTION

3.01 GENERAL

A. Refer to Section 26 0535, BOXES, for outlet box requirements.

B. All devices shall be installed in appropriate boxes designed for the purpose, in accordance with manufacturer's directions.

C. Adjacent outlets of any type, including dimmers and fan speed controls, shall be installed in multi-gang boxes with a single multi-gang faceplate.

3.02 INSTALLATION

A. Locations, unless otherwise required by local codes or noted on the drawings (dimensions in center):

1. Switches: 42 in. above finished floor, 4 in. from doorjamb on strike side of door.
2. Receptacles: 1 ft. 6 in. above finished floor, except where indicated above a countertop.
3. Telephone and data outlets: 1 ft. 6 in. above finished floor, except where indicated above a countertop.

B. Grounding: Provide AWG 12, green color, insulated copper ground bonding jumpers for all switches and receptacles, bonded to the grounding screw provision within the box with separate grounding screw or lug.

C. Low Voltage System Outlets: Provide minimum (1) 1.00” conduit stub up to accessible above-ceiling space, turned toward system source or above-ceiling system wiring pathway, as applicable. Where combination system box is used, provide separate raceway for each system type.

D. Device Labeling (applies to branch circuit devices wiring outlets under this section):

1. Provide adhesive backed label on each wall switch and receptacle device outlet coverplate indicating panelboard served from and circuit number (i.e.: L-6).
2. Labels shall be made on 3/8” or ½” inch stock, black color letters with clear background.
3. Label system shall be Brother “P-Touch” System or equivalent.
4. Labels shall not be applied until final touch-up painting is complete and covers are permanently mounted.
5. Provide labels using a black permanent marking pen on each associated receptacle box and switch box indicating panelboard number and circuit number.

E. Occupancy based lighting controls system commissioning:

1. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.
2. The manufacturer's factory authorized technician shall, upon completion of the commissioning, provide a written report to the Contractor, Design Professional, Comissioning Agent, and Project Manager indicating completion of the work. This report shall also indicate any correction actions required on the part of the contractor.

END OF SECTION

SECTION 26 28 00
LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes disconnect switches, separate individually-enclosed circuit breakers, contactors and fuses for other than devices furnished with integral current-limiting fuses, such as fused circuit breakers and motor circuit protectors.

B. Spare fuses of all types are included in this section.

C. Provide required fuses, including spare fuses, for all fusible equipment furnished under this division.

1.02 NAMEPLATES

A. Provide engraved “lamicore” nameplates for all disconnect switches, and individually enclosed circuit breakers, indicating the equipment served. Refer also to Section 26 05 63 - Identification For Electrical Systems.

1.03 SPARE FUSES

A. Provide (3) three spare fuses of each type and rating for all power and control fuses, including current-limiting fuses furnished as an integral part of fused circuit breakers or motor circuit protectors.

1.04 SUBMITTAL DOCUMENTS

A. Required for all equipment specified by this section.

B. Circuit breaker submittal shall indicate device ratings, including interrupting capacity, dimensions of enclosure, and wire bending space.

1.05 OPERATION AND MAINTENCE MANUALS

A. Provide record copy of all submittal documents and assemble as identified in another section.

PART 2 - PRODUCTS

2.01 GENERAL

A. All devices shall be UL labeled.

2.02 FUSES

A. Manufacturer:
   1. Bussman
   2. Ferraz-Shawmut
   3. Little-Fuse

B. Fuses applied on circuits operating at 250 Volts or less shall be 250 Volt rated.

C. Fuses applied on circuits operating at 600 Volts or less shall be 600 Volt rated.

D. All fuses shall have an interrupting capacity of 200,000 amps, RMS symmetrical, at rated voltage.

E. Fuses for transformer feeders and motor branch circuits shall be dual-element time delay, current-limiting, Class J for 600 Amp and smaller, Class L for larger than 600 Amp.

F. Fuses for feeders, control circuits, and other loads shall be fast acting, current limiting, Class J for 600 Amp and smaller, Class L. for larger than 600 Amp.

2.03 DISCONNECT SWITCH (SAFETY SWITCH)

A. Manufacturer:
   1. Cutler-Hammer
   2. General Electric
   3. Siemens

4. Square D

B. Shall be of the fusible, or non-fusible type, as indicated on the drawings.

C. Shall be heavy duty, quick-make, quick-break, HP rated, hinged cover dual interlocked with switch handle and with external interlock defeat mechanism, with provision for handle and door padlocking.

D. In dry locations shall be Type NEMA 1 enclosed.

E. In damp locations, or outdoors, shall be Type NEMA-3R, enclosed, except where the applied use requires an alternate Type NEMA enclosure rating.

2.04 DOUBLE-THROW DISCONNECT SWITCH

A. Manufacture:

1. Cutler-Hammer
2. Siemens
3. Square D
4. General Electric

B. Shall be of the fusible or non-fusible type as indicated on the drawings.

C. Shall be heavy duty, quick-make/quick-break, load-make/load-break rated, HP rated, hinged cover dual interlocked with switch handle and with external interlock defeat mechanism, with provision for handle and door padlocking.

D. Switch handle shall have padlocking provisions in all (3) three switch positions and external interlock defeat mechanism.

E. Installed in dry locations: Type NEMA-1 enclosed.

F. Installed in damp locations or outdoors: Type NEMA-3R enclosed, except where the applied use requires an alternate Type NEMA enclosure rating.

G. Provide separate ground bus. Provide insulated neutral bus where the scheduled feeder contains a neutral conductor.

H. Provide lugs sized for actual feeder conductors where standard factory lugs are not suitable.

2.05 INDIVIDUALLY ENCLOSED CIRCUIT BREAKERS

A. Manufacturer:

1. Cutler-Hammer
2. General Electric
3. Siemens
4. Square-D Company

B. Breakers shall be of appropriate frame size for the indicated trip setting, and rated for the applied circuit voltage. Fault current interrupting rating of each breaker shall be as noted on the drawings, minimum 42,000 A.I.C.R.

C. Installed in dry locations: NEMA-1, enclosed.

D. Installed in damp locations or outdoors: NEMA-3R enclosed, except where the applied use requires an alternate rating.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount disconnects on building structural elements, or on auxiliary framing, with top at 6'-0” A.F.F. where allowed by surrounding conditions.

B. Devices shall not be supported from, or mounted to, equipment of other trades unless approved in writing by the manufacturer of that equipment.

C. Raceways connecting NEMA-3R enclosed devices shall be installed in such a manner as to prevent the entry of water. Raceways shall enter only the bottom of the enclosure.

D. Provide engraved lamicore nameplate for each disconnect and separately enclosed breaker. Nameplates shall state source of circuit, load served, circuit number, voltage, and phase. Refer to Section 26 05 63 - Identification for Electrical Systems.

E. Provide disconnect switches for all motors, HVAC, plumbing equipment, and other electrically operated equipment where not connected by cord and plug, unless fed from a motor control center located in the immediate area of the motor. Disconnect switches shall be fused where equipment manufacturers electrical data label plate states “Maximum Fuse Size”, or similar wording.

END OF SECTION

SECTION 26 33 05
BATTERY EMERGENCY POWER SUPPLY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Emergency power supply for life safety lighting.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems; 2013.

1.03 SUBMITTALS

A. Product Data: Provide catalog and data sheets showing electrical characteristics and connection requirements. Include unit ratings, dimensions, and finishes. Include performance data for batteries.

B. 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 starting of product.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include battery maintenance and unit testing procedures.

1.04 QUALITY ASSURANCE

A. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acuity Brands, Inc: www.acuitybrands.com.

B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.

C. Hubbell Lighting, Inc: www.hubbelllighting.com.

D. Myers Power

E. IPS

F. Philips Chloride

G. Exide

2.02 EMERGENCY POWER SUPPLY

A. Description: NFPA 111 Type A, Class 1.5 stored emergency power supply system designed for Level 1 applications and consisting of rectifier/charger unit, storage battery, and solid state inverter with static transfer switch, in one or several enclosures.

2.03 RATINGS

A. Input Voltage: 277 volts, 60 Hz, single phase.

B. Output Voltage: 277 volts plus 5 percent, single phase.

C. Inverter Output Frequency: 60 Hz plus 1 percent.

D. Efficiency: 90 percent minimum.

E. Maximum Recharge Time: 12 hours following 1.5 hour discharge.

F. Total Harmonic Distortion: Less than 10 percent at full resistive load.

G. Battery: Nickel cadmium, sealed type battery.

H. Accessories: Provisions for remote battery alarm.

I. LCD Touchcreen with Bacnet/IP connection to DDC system.

J. Distribution cabinet with (3) 480V/3 pole 20A breakers and (3) 277V/1p 20A breakers.

K. Instrumentation and Alarms: NFPA 111.

L. Charger: Dual rate, designed to maintain battery in full-charge condition during normal conditions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units plumb and level.

3.02 FIELD QUALITY CONTROL

A. Verify operation of each unit by simulating outage.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate normal operation of unit.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.
B. Surge protective devices for distribution locations.
C. Surge protective devices for branch panelboard locations.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
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.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 ALL SURGE PROTECTIVE DEVICES

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated; system voltage as indicated on the drawings.
B. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.
   2. Delta Systems: L-G, L-L.
C. 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.
   2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
E. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
F. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Panelboards: See Sections 26 24 16 and 262417.

2.02 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
B. 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.
C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.
D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
E. UL 1449 Nominal Discharge Current (I-n): 20 kA.

F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

G. Diagnostics:

1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.03 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Unless otherwise indicated, provide factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Distribution locations include SPDs connected to distribution panelboards.

D. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

E. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

H. Diagnostics:

1. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.04 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.

E. UL 1449 Nominal Discharge Current (I-n): 20 kA.

F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

G. Diagnostics:

1. Protection Status Monitoring: Provide indicator lights to report the protection status.
2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

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

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

F. 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.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.01 SCOPE

A. Lighting fixtures, emergency battery ballasts, and associated equipment.

B. Lighting control system is specified on the Drawings.

1.02 STANDARDS

A. All material shall bear the label of the Underwriters Laboratories, Inc.

1.03 VOLTAGE

A. Fixture voltage is indicated by circuit in which it is connected. Contractor shall determine fixture voltage from drawings.

1.04 CEILING INTERFACE

A. Specific catalog numbers shown for fixtures do not necessarily describe all mounting hardware or accessories required for a particular installation. Determine ceiling types from the finish schedule specified under another division, and furnish all required materials for a complete and proper installation. Provide plaster frames for wet plaster or stucco ceilings.

1.05 COORDINATION

A. Provide other trades with a schedule of the outside dimensions of each type of recessed fixture when submittal documents have been approved. Examine applicable plans and shop drawings describing the work of other trades for possible conflicts in the clearances required for installation. The architect shall be notified prior to fabrication of any material of any conflict that cannot be resolved at no cost to the Owner by normal jobsite coordination between trades.

1.06 SUBMITTAL

A. Furnish a bill of material cover sheet and original data sheet, combined into binder, describing each fixture type. If a catalog page describes more than one fixture, the page shall be appropriately marked identifying the exact item being submitted. Photometric data shall be submitted for each fixture type that has a reflector or lens for directing the light output. Drawings larger than 8 ½ x 14 shall be submitted in 8 ½ x 11 envelopes bound into the submittal brochure.

B. Copy of Solid State Ballast warranty.

C. Point by point plot on a scaled drawing to indicate the foot-candle performance of all interior and exterior fixtures.

D. Where equivalent manufacturers for lighting fixtures are not indicated or scheduled, the specified manufacturer's fixture shall be provided.

1.07 OPERATING AND MAINTENANCE MANUAL

A. Provide record copy of submittal documents.

B. Bind all information together with other Division 26000 manuals.

PART 2 - PRODUCTS

2.01 LUMINAIRES

A. LED Luminaires

1. UL or ETL Listed and labeled.
2. Minimum 80 CRI.
3. 5 year warranty minimum.
4. Tested to LM-79 and LM-80 standards minimum.
5. Lumen maintenance: 70% lumen output for 50,0000 hours
6. Efficacy: minimum 60 lumens/watt

7. Constructed such that the LED modules may be replaced or repaired without replacement of the entire fixture.
8. Power Factor: 0.9
9. Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency. All LED individual fixture types must be shipped at the same time and stored on site to ensure that products have been produced from the same bin. Tolerances greater the 200K will not be acceptable
10. For exterior application, all white LED's shall have a color temperature of 70 and above.
11. Fixtures used on the exterior building facades shall have a minimum IP65 rating. All LED fixtures and power/data supplies shall be provided by a single manufacturer to ensure compatibility.
12. All LED fixtures (100% of each lot) shall undergo a minimum eight hour burn in test during manufacturing.
13. All LEDs used in the LED fixture shall be high brightness and proven quality from established and reputable LED manufacturers in business for greater than 5 years.
14. Manufacturer shall provide optical performance, polar diagrams, and relevant luminance and illuminance photometric data based on test results from an independent testing lab.
15. White LED sources must meet the following requirements:
    a. Luminaires must be rated for -40°C to +50°C operation
    b. Duv tolerance of 0.001 ± 0.006
16. Luminaire manufacturer must submit reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows:
    a. High Temperature Operating Life (HTOL)
    b. Room Temperature Operating Life (RTOL)
    c. Low Temperature Operating Life (LTOL)
    d. Powered Temperature Cycle (PTMCL)
    e. Non Operating Thermal Shock (TMSK)
    f. Mechanical shock
    g. Variable vibration frequency
    h. Solder Heat Resistance (SHR)
17. Electronic driver for LED fixtures shall comply with UL 1310 Class 2 requirements for dry and damp locations. include the following:
    a. Rated for 50,000 hours of life
    b. Sound Rating: Class A
    c. Total Harmonic Distortion: 15% or less
    d. Current Crest Facto: 1.5 or less
    e. 0-10V Dimming

B. Emergency Battery Ballasts
1. 1200 lumen output minimum
2. Self-diagnostic function
3. Ballast integral and contained within fixture housing
4. Test switch integral with fixture housing
5. Illumination time: 90 minutes

2.02 FIXTURE TYPES:

A. As scheduled on the drawings.

PART 3 - EXECUTION

3.01 LOCATION

A. The exact location of all fixtures in finished areas shall be as shown on the reflected ceiling plans. If the location shown on the reflected ceiling plan for a fixture differs from the location shown on the electrical plans, the fixture shall be installed as shown on the reflected ceiling plan. In utility and mechanical rooms the contractor shall adjust the location and mounting height of the indicated fixtures for best coordination with the work of other trades.

3.02 INSTALLATION

A. Flexible conduit connections to recessed fixtures shall be (10) ft. lengths of 3/8-inch steel flex with flex connectors as specified in the “Basic Materials and Methods” section. The flexible connections shall contain stranded conductors, AWG #14 minimum, Type THWN, with a separate grounding conductor bonded securely to the fixture housing.

B. Flexible conduit connections to recessed fixtures located in accessible ceilings shall be installed such that each fixture can be relocated (1) ceiling tile space in any direction.

3.03 SUPPORTS AND ANCHORS

A. Refer to Section 260548 - Vibration and Seismic Controls, for additional support and anchor requirements.

B. Fixtures shall not be supported from ducts or piping of other trades without the approval of the architect.

C. Recessed fixtures not designed to lay-in a ceiling grid, and suspended fixtures, shall be supported by a threaded rod dropped from approved channels or brackets transmitting the fixture weight to the building structure. If the fixture is outlet box mounted, the box shall be supported in the same manner.

D. Hardware and unpainted metal used for mounting of exterior fixtures shall electrogalvanized.

3.04 ACCEPTANCE

A. Target and focus adjustable fixtures in the presence of the Architect.

B. All fixtures trims shall be free of light leaks as viewed from the occupied space. Suitably seal around trims to eliminate any light leakage around downlight trims and fluorescent fixtures. Louvers and lens shall be clean and free from fingerprints, dust, and physical damage.

END OF SECTION

SECTION 26 56 68
INTERIOR ATHLETIC LIGHTING

PART 1 - GENERAL

1.01 SCOPE

A. Lighting fixtures and associated equipment for indoor Tennis Facility.

B. The purpose of this specification is to define the performance and design standards for the project. Supply lighting equipment to meet or exceed the standards set forth by the criteria in this specification.

1.02 STANDARDS

A. All material shall bear the label of the UL or ETL.

B. Lighting design shall meet recommended IES, Tenth Edition luminance values for Indoor Tennis Courts.

1.03 DEFINITIONS

A. CV: Coefficient of variation; a statistical measure of the weighted average of all relevant illumination values for the playing area, expressed as the ratio of the standard deviation for all illuminance values to the mean illuminance value.

B. Illuminance: The metric most commonly used to evaluate lighting systems. It is the density of luminous flux, or flow of light, reaching a surface divided by the area of that surface.

1. Horizontal Illuminance: Measurement in foot-candles, on a horizontal surface 36 inchesabove ground unless otherwise indicated.
2. Target Illuminance: Average maintained illuminance level, calculated by multiplying initial illuminance by LLF.
3. Vertical Illuminance: Measurement in foot-candles, in four directions on a vertical surface, at an elevation coinciding with plane height of horizontal measurements.

C. LC: Lighting Certified.

D. Light Trespass: Light spill into areas and properties outside the playing areas, which is either annoying or unwanted.

E. LLD: Lamp lumen depreciation, which is the decrease in lamp output as the lamp ages.

F. LLF: Light loss factor, which is the product of all factors that contribute to light loss in the system.

G. Luminaire: Complete lighting fixture.

H. UG: Uniformity gradient; the rate of change of illuminance on the playing field, expressed as a ratio between the illuminances of adjacent measuring points on a uniform grid.

1.04 PERFORMANCE REQUIREMENTS

A. Lighting for indoor tennis shall be glare free and provide visibility of the ball for players and spectators from the time it is tossed in the air by the server along every path it follows, as long as the ball is in play.

B. The average maintained light intensity shall be 75 foot-candles within the Primary Playing Area (PPA), with individual light fixtures placed in locations as specified by USTA guidelines for indoor courts.

C. The uniformity ratio (max. /min.) of lighting levels within the PPA of the court shall be between 1.5 to 2.0.

D. All fixtures shall be located outside the doubles sidelines of the tennis courts.

E. Reflectance: confirm floor, ceiling, and wall reflectances with architect based on final finish selections.

F. Facility Type: College.

G. LED Fixture Criteria:

1. Solid state
2. FCC compliant
3. IP66, -40 degree C to 55 degree C
4. HDTV compliant, (no flicker)
5. Antiglare lens
6. L70 tested and rated for >72,000 hours

H. Illumination Criteria:
1. Minimum Average Target Horizontal Illumination: 75 footcandles at 36 inches above the playing surface.
2. Minimum Average Target Vertical Illumination 75 footcandles at 36 inches above theplaying surface: 7
3. CV: 0.13
4. Maximum-to-Minimum Uniformity Ratio: 2.0 or less.
5. UG Level: 1.5 or less.
6. Reflectance: 24 floor, 70 ceiling, 70 wall

I. Illumination Calculations: Computer-analyzed point method complying with IESNA RP-6 to optimize selection, location, and aiming of luminaires.
1. Grid Pattern Dimensions: For playing areas of each sport correlate and reference calculated parameters to the grid areas. Each grid point represents the center of the grid area defined by the length and width of the grid spacing.
2. Determine LLF according to IESNA RP-6 and manufacturer's test data.
3. Luminaire Mounting Height: See architectural drawings.

J. Egress Lighting: In case of power failure, provide a minimum of 1.0-fc average (0.1-fc min) illumination for egress, within 10 seconds, measured at floor level.

K. Lighting Control: Manual, low voltage, or digital; providing the following functions, integrated into a single control station, with multiple subcontrol stations as indicated:
1. Master Control Station: Key-operated master switch, three manual push-button controls, and system status indicator lights. Test switch of egress lighting system.
2. Sub-control station: Key-operated, single manual push-button control.
3. Automatic lighting shutoff control to turn non-egress fixtures off when building is unoccupied via occupancy sensor or time based relay panel or a combination of both.

L. Electric Power Distribution Requirements:
1. Electric Power: 480 V; single phase.
   a. Balance load between phases. Install wiring to balance three phases at each support structure.
   b. Include required overcurrent protective devices and individual lighting control.

M. Seismic Performance: Luminaires, ballasts, and support structures shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 SUBMITTALS

A. Submittals for Pre-bid:
1. Product Data: Furnish a bill of material cover sheet and original data sheet, describing each fixture type. If a catalog page describes more than one fixture, the page shall be appropriately marked identifying the exact item being submitted.
   a. Product data shall include lamp life, lumen output, and energy-efficiency data.

2. Photometric Data: Floor plan drawings and product specifications for a complete field lighting system.
   a. Footcandle levels (horizontal and vertical) showing evidence of compliance with the three levels of lighting designated in the Performance section of this specification.
   b. Life safety footcandle levels on the floor.
   c. Manufacturer's LLF used in design calculations.
3. Compliance to Specifications: Acceptance of a pre-bid does not negate the contractor and lighting manufacturer’s responsibility to comply fully with the requirements of these specifications. Any exceptions to the specifications must be clearly stated. Provide a line by line list of any exceptions and/or deviations to the specification.

B. Submittals for Review:
1. Product Data: Furnish a bill of material cover sheet and original data sheet, describing each fixture type. If a catalog page describes more than one fixture, the page shall be appropriately marked identifying the exact item being submitted.
2. Shop Drawings: Indicate location of each fixture and mounting height. Provide wiring diagrams and location of each device.
3. Manufacturer's 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.
4. Photometric Data: Floor plan drawings and product specifications for a complete field lighting system.
   a. Footcandle levels (horizontal and vertical) showing evidence of compliance with the three levels of lighting designated in the Performance section of this specification.
   b. Life safety footcandle levels on the floor.
5. Provide wattage information for each luminaire.
6. Wiring requirements, including required conductors and cables and wiring methods.
7. Controls information including required wiring and installation details.
8. Structural analysis data and calculations used for structure mounting.
9. Seismic Qualification Certificates for lumiaires, accessories, and components.
   a. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   b. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements
   c. Manufacturer Certificates: For support structures, including brackets, arms, appurtenances, bases, anchorages, and foundations, from manufacturer.
   d. Welding certificates.
10. Warranty

C. Submittals for Project Closeout:
1. Copies of final shop drawings, product data, manufacturer's instructions and test reports.
2. Project Record Documents: Record actual locations fixtures and devices.
3. Operation and Maintenance Data: Include spare parts listing and recommended maintenance procedures and intervals.
4. Warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: Manufacturer's responsibilities include fabricating sports lighting and providing professional engineering services needed to assume engineering responsibility.

1. Engineering Responsibility: Preparation of design submittals and comprehensive engineering analysis by a qualified LC by the National Council on Qualifications for the Lighting Professions.

C. Luminaire Photometric Data Testing Laboratory: By an independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" and AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of luminaires, lamps, and luminaire alignment products and to correct misalignment that occurs subsequent to successful acceptance tests. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, and unauthorized repairs and alterations from special warranty coverage.

1. Luminaire Warranty: Luminaire and luminaire assembly shall be free from defects in materials and workmanship for a period of ten years from date of Substantial Completion.
2. Warranty of Led Fixtures: Owner will seek written assurances from the manufacturer that the product will perform as claimed in terms of life.
   a. Provide a written ten year on site replacement material, fixture finish, and workmanship. On site replacement includes transportation, removal, and installation of new products. Finish warranty must include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading.
   b. Provide a written ten year replacement material warranty for defective or non starting LED source assemblies.
   c. Provide a written ten year replacement material warranty on all power supply units (PSUs).
   d. Provide a written ten year replacement warranty for luminaires producing inadequately maintained illuminance levels at end of warranty period, as prorated from levels expected at end of useful life. For example, a luminaire expected to produce 70% of initial lumens at 100,000 hours would be expected to last over 11 years (continuous operation), so levels would be expected to be at 87% of initial at end of five year warranty period. Warranty must cover all light sources (LED package, LED array, or LED module) including, but not limited to the LED die, encapsulate, and phosphor. If the expected useful life of the luminaire system is not achieved, the manufacturer must replace the light source(s) or luminaire as needed at no cost to the University.
3. Alignment Warranty: Accuracy of alignment of luminaires shall remain within specified illuminance uniformity ratios for a period of two years from date of successful completion of acceptance tests.
   a. Realign luminaires that become misaligned during the warranty period.
   b. Replace alignment products that fail within the warranty period.
   c. Verify successful realignment of luminaires by retesting.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design
   1. Ephesus Lighting: ephesuslighting.com

B. Alternative for owner review
   1. Musco: musco.com
   2. Flex Lighting Solutions: www.flexlightingsolutions.com

2.02 LED LUMINAIRES

A. UL or ETL Listed and labeled.

B. 5600 degree Kelvin color temperature and minimum 80 CRI.

C. 10 year warranty minimum.

D. Tested to LM-79 and LM-80 standards minimum.

E. Lumen maintenance: 70% lumen output for 50,0000 hours

F. Efficacy: minimum 60 lumens/watt

G. Constructed such that the LED modules may be replaced or repaired without replacement of the entire fixture.

H. Power Factor: 0.9

I. Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency. All LED individual fixture types must be shipped at the same time and stored on site to ensure that products have been produced from the same bin. Tolerances greater the 200K will not be acceptable

J. All LED fixtures (100% of each lot) shall undergo a minimum eight hour burn in test during manufacturing.

K. All LEDs used in the LED fixture shall be high brightness and proven quality from established and reputable LED manufacturers in business for greater than 5 years.

L. Manufacturer shall provide optical performance, polar diagrams, and relevant luminance and illuminance photometric data based on test results from an independent testing lab.

M. White LED sources must meet the following requirements:

1. Luminaires must be rated for -40°C to +50°C operation
2. Duv tolerance of 0.001 ± 0.006

N. Luminaire manufacturer must submit reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows:

1. High Temperature Operating Life (HTOL)
2. Room Temperature Operating Life (RTOL)
3. Low Temperature Operating Life (LTOL)
4. Powered Temperature Cycle (PTMCL)
5. Non Operating Thermal Shock (TMSK)
6. Mechanical shock
7. Variable vibration frequency
8. Solder Heat Resistance (SHR)

O. Electronic driver for LED fixtures shall comply with UL 1310 Class 2 requirements for dry and damp locations. include the following:

1. Rated for 50,000 hours of life
2. Sound Rating: Class A
3. Total Harmonic Distortion: 15% or less
4. Current Crest Facto: 1.5 or less

2.03 SUPPORT STRUCTURES

A. Support-Structure Seismic Strength: support structures, brackets, arms, appurtenances, etc. shall be designed to prevent separation of components, luminaire supports, etc. during a seismic event.

B. Mountings, Fasteners, and Appurtenances:

1. Corrosion resistant, compatible with support components, and which shall not cause galvanic action at contact points.
   a. Mounting Hardware Fasteners: Hot-dip galvanized, complying with ASTM A 153/A 153M, or minimum 18-8 grade stainless steel.
2. Accommodate attachments and wiring of other indicated systems.

2.04 SURGE PROTECTION

A. Provide in lighting panel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction including HVAC equipment, fire-suppression system, and structure.

B. Suspended Lighting Fixture Support
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   3. Provide structure attached leveling and stabilizer chains in addition to fixture support.

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Fixture shall sustain electrical connection with normal building vibration. Provide hard wired connection or a locking receptqacle quick connection.

3.02 ACCEPTANCE

A. Testing Agency: Engage a third party qualified testing agency to perform tests, inspections, and analysis.

B. Perform tests, inspections, and analysis according to IESNA RP-6 and IESNA LM-5 where applicable.
   1. After installing sports lighting system and after electrical circuits have been energized, perform proof-of-performance field measurements and analysis to verify compliance with requirements.
   2. Playing and Other Designated Areas: Make field measurements at intersections of grids, dimensioned and located as specified in "Performance Requirements" Article and as described below:
      a. Tennis Courts: Measure at least 120 points.
   3. Perform analysis to demonstrate correlation of field measurements with specified illumination quality and quantity values and corresponding computer-generated values that were submitted with engineered design documents. Submit a report of the analysis.

C. Correction of Illumination Deficiencies for Playing Areas: Make corrections to illumination quality or quantity, measured in field quality-control tests, that varies from specified illumination criteria by plus or minus 10 percent.
   1. Add or replace luminaires, revise aiming, or install louvers, shields, or baffles.
   2. If luminaires are added, revise aiming and recalculate and modify or replace support structures if indicated.
   3. Do not replace luminaires with units of higher or lower wattage without Architect's approval.
   4. Retest as specified above after repairs, adjustments, or replacements are made.
   5. Report results in writing.

3.03 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the interior athletic lighting. Include sixteen hours of on-site training.

B. Include sixteen hours of technical support during the first year. Technical support requests will be initiated by and scheduled at the request of the Owner.

END OF SECTION

SECTION 27 0100
GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Specifications, Standards, and Codes
   1. All work shall be in accordance with the following:
      a. This Technical Specification and Associated Drawings
      b. TIA/EIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
      c. TIA/EIA 568-C.1 Commercial Building Telecommunications Cabling Standard
      d. TIA/EIA 568-C.2 Balanced Twisted Pair Cabling Components Standard
      e. TIA/EIA 568-C.3 Optical Fiber Cabling Components Standard
      f. TIA/EIA 942 Telecommunications Infrastructure for Data Centers
      g. TIA/TIA 569-A Commercial Building Standard for Telecommunications Pathways and Spaces
      h. TIA/EIA 606-A Administration Standard for the Telecommunications Infrastructure of Commercial
      i. ANSI-J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
      j. ANSI/TIA-758-A Customer Owned Outside Plant Telecommunications Infrastructure Standard
      k. National Fire Protection Agency (NFPA)-70 National Electric Code (NEC)
      l. UL 50 Enclosures for Electrical Equipment
      m. Current design and installation contractor agreement with single solution manufacturer.
   2. If a conflict exists between applicable documents that cannot be verbally negotiated between the contractor and the owner, then the order in the list above starting with #1 above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by a local, state, or federal inspection agency. If a conflict is found, it shall be the discovering party's responsibility to notify the Architect of these specifications for clarification and resolution.
   3. The contractor shall comply with all requirements for permits and tests, shall provide all certificates, and shall pay all costs for same.

1.02 SCOPE

A. The work to be done under this Section of the Specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Telecommunications Infrastructures and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the architect shall be notified of the discrepancy.

1.03 WORK INCLUDED

A. The Communications Infrastructures installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:
   1. Horizontal and Backbone Cabling Infrastructure
   2. Telecommunications conduits, raceways, cable tray, racks, cabinets and equipment mounting boards as indicated on the Drawings.
   3. Grounding and Bonding

4. Concrete work for wall and floor penetration.

1.04 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the GENERAL REQUIREMENTS and are applicable to the TELECOMMUNICATIONS WORK SCOPE.

B. Provide: As used herein shall mean "furnish, install and test (if applicable) complete".

C. Infrastructure: As used herein shall mean cable, installed in conduit, raceway, or cable tray with all required boxes, fittings, connectors, and accessories; completely installed."

D. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

1.05 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop Drawings, equipment location Drawings, foundation Drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.

E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Technology plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

J. Review all architectural Drawings for modular furniture.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "shall be", "as indicated on the Drawings", "In accordance with", "a", "the" and "all are intended" shall be supplied by inference.

1.06 SUBMITTALS

A. Before installation of any cable or support equipment the contractor shall submit shop drawings and product data for the RCDD and designer for review and approval. The

contractor shall indicate installation details, cable routing, system configurations, and outlet numbering on all drawings. The contractor shall submit all appropriate product data for each component to be supplied. The contractor shall also submit manufacturer installation instructions. Three (3) copies of all the above and following shall be submitted.

B. Submittals for individual systems and equipment assemblies that 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, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.

C. Immediately after reward, the contractor shall submit a construction schedule listing construction milestones including: delivery of construction materials, staffing, backbone installations, equipment room fit-out, horizontal cable installation, testing, and pre-final and final construction observations.

D. Also after reward, contractor to submit Schedule of Value that coincides with construction schedule. This schedule of values shall be used for evaluation of pay requests. Schedule of Values to include all labor and material costs.

E. Project Record Documents: The record documents shall be bound and consist of the following:
   1. Product cut sheets for all products supplied.
   2. Test reports for horizontal cabling.
   3. Test reports for backbone cabling.
   4. Manufacturer Warranties
   5. “D-Size” As-Built drawings.

F. As-Built drawings should accurately record location of service entrance conduit, termination backboards, outlet boxes, cable raceways, cable trays, pull boxes, and equipment racks electronically using AutoCAD 2015 or later version and on minimum “D” size reproducible paper prints.

G. The contractor shall prepare 11” x 17” as-built serving zone drawings for each Telecommunication Room. The drawing shall be laminated, framed, and secured to the wall in the Telecom Room.

1.07 QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories or certification by other recognized laboratory, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

C. The Owner reserves the right to send its RCDD as a representative to inspect the job site during construction to ensure compliance with the Contract Documents.

1.08 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated telecommunications systems.

B. Telecommunications Systems specified shall be installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Contractor to the Project Engineer of the following:

1. List of three (3) reference accounts at which similar work, both in scope and design, have been completed by the contractor with the last two (2) years.
2. The credentials (current BICSI certification stamp) of the responsible RCDD must be attached to the contractor's response for evaluation by the Project Engineer.

C. Contractor must be licensed in the State of Georgia as a Telecommunications Class or Unrestricted Class Low-Voltage Contractor (LVL).

D. The Licensed Low-Voltage Telecommunications Contractor (LVLTC) must be based in the State of Georgia.

E. The installation of all cable, equipment, terminations, & associated services should be performed by a company that is currently a Manufacturer's Certified Structured Cabling System installer in good standing with minimum of three (3) years of experience on similar systems.

F. The installation company must have an RCDD on staff performing the role of Project Manager and be available for consultation and to attend project meetings.

G. A BICSI certified installer shall be employed by the contractor and be on site as the installation manager.

H. Installer's Qualifications:
1. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
2. General electric trade staff shall not be used for the installation of the premises' distribution system cables and associated hardware.
3. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.
4. Installer must be a current Certified Installer and must submit the current certificate with their proposal

1.09 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate telecommunications work with that of other Sections as required to ensure that the entire telecommunications work will be carried out in an orderly, complete and coordinated fashion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS – COPPER CONNECTIVITY SYSTEM

A. All copper cables and components shall be provided and installed by manufacturer certified installers that shall provide an extended warranty of 25 years for certified installations. Manufacturer shall provide warranties and contractor shall provide documentation of certification by manufacturer. Acceptable copper solution manufacturers shall be the products of the following manufacturers:
1. CommScope
2. Panduit
3. Leviton
4. Belden
5. Ortronics

B. The contractor shall maintain a current status with the manufacturer, including all training requirements, for the duration of the Project. The Contractor shall staff each installation crew with the appropriate number of trained personnel in accordance with their current contract agreement to support the 25-Year System Warranty requirements. After installation, the Contractor shall submit all documentation to support the requirements of the Warranty and to obtain said warranty on behalf of the owner. The warranty will cover the components and labor associated with the

repair/replacement of any defective link within the warranty period when the defect is a valid warranty claim.

2.02 ACCEPTABLE MANUFACTURERS – FIBER OPTIC CONNECTIVITY SYSTEM

A. All fiber optic cables and components shall be provided and installed by manufacturer certified installers that shall provide an extended warranty of 25 years for certified installations. Manufacturer shall provide warranties and contractor shall provide documentation of certification by manufacturer. Acceptable fiber optic solution manufacturers shall be the products of the following manufacturers:
   1. Corning
   2. Optical Cable Corporation (OCC)
   3. CommScope
   4. Panduit
   5. Leviton
   6. Ortronics

B. The contractor shall maintain a current status with the manufacturer, including all training requirements, for the duration of the Project. The Contractor shall staff each installation crew with the appropriate number of trained personnel in accordance with their current contract agreement to support the 25-Year System Warranty requirements. After installation, the Contractor shall submit all documentation to support the requirements of the Warranty and to obtain said warranty on behalf of the owner. The warranty will cover the components and labor associated with the repair/replacement of any defective link within the warranty period when the defect is a valid warranty claim.

2.03 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer, but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

PART 3 EXECUTION

3.01 EXAMINATION OF SURFACE CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.02 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Project Manager, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Project Manager shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.03 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. "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 motors, pumps, belt guards, transformers, piping and duct work.

3.04 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by telecommunications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.05 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Testing, start-up and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.06 TESTING AND VERIFICATION

A. See specific Low Voltage sections for testing parameters of sub-systems.

B. The Contractor shall verify that requirements of this specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.

D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the telecommunications systems, components and subsystems meet specification requirements in the "as-installed" operating environment during the "System Operation Test". Even though no formal environmental testing is required, the Contractor shall measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the "System Operation Test".

E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Telecommunications Contractor Project Manager and submitted for approval.

END OF SECTION

SECTION 27 0528
PATHWAYS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of interior telecommunications pathways and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 SUBMITTALS

A. Provide product data.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install complete Conduit System – Reference Electrical Specifications.
   2. Furnish and install all Telecommunications Outlet Boxes.
   3. Furnish and install all Pull Boxes.
   4. Furnish and install complete Cable Tray System.
   5. Furnish and install all Velcro Straps.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Velcro Strap manufacturer(s):
   1. Panduit
   2. Tyco
   3. Hubbell
   4. Or Approved Equal

B. Innerduct
   1. Exposed innerduct shall be rated CMP (plenum), corrugated plastic equipped with pull-string or mule tape.
   2. Sizes shall be 2”, 1-1/4” & 1” inside diameter.
   3. See Drawings for innerduct details.

2.02 PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

2.03 VELCRO STRAPS

A. Velcro Straps
   1. Cables shall be fastened to support structures with Velcro straps.
   2. Velcro straps installed in air handling spaces must be plenum rated.
      a. Plenum Velcro strap color shall be red.
   3. Use 1-inch wide Velcro to secure cables to all support structures.

PART 3 EXECUTION

3.1 CABLE INSTALLATION

A. Install cables only when cable tray installation has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

3.3 CONNECTIONS

A. Ground cable trays according to manufacturer's written instructions.

B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

3.4 FIELD QUALITY CONTROL

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:
   1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
   2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
   3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
   4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
   5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
   6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
   7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

3.5 PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X-ray all floor penetrations accordingly.

B. Holes shall be located so as not to affect structural sections such as ribs or beams.

C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.

D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.

E. All penetrations where conduit is not used shall be sleeved.

F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.6 CONDUIT SYSTEM

A. All conduit shall not be less than 3/4” trade size.

B. No more than two 90 degree sweep bends or the equivalent shall be permitted between junction boxes, pull boxes, cabinets, or cable access points.

C. Conduit shall be provided as a continuous run perpendicular from the cable tray to the work area outlet. All cables shall be enclosed in conduit or cable tray for protection.

D. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.

E. Leave all empty conduits with a 200 pound test nylon cord pull line.

F. A 200 pound test nylon cord pull line shall be co-installed with all cable installed in any conduit.

G. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

H. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

I. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

J. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

K. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

L. Where conduits must pass through structural members obtain approval of Architect.

M. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

N. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

O. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas. PVC to be installed below concrete in grade. Contractor to utilize Rigid Galvanized Steel (RGS) elbows for all slab penetrations and stub-ups.

P. Telecommunications cables shall not occupy conduits with power cables.

Q. Metallic conduits shall be grounded in accordance with J-STD-607-A.

R. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.

S. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

T. Telecommunications conduit system shall contain no condulets (also known as an LB).

U. Horizontal Conduits
   1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

3.7 TELECOMMUNICATIONS OUTLET BOXES

A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

B. The approximate locations of the outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

C. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.

D. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.

E. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.

F. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

3.8 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

D. Pull boxes shall be installed in accordance with ANSI/TIA/EIA-569-A.

E. Pull boxes shall be grounded in accordance with J-STD-607-A.

3.9 VELCRO STRAPS

A. Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Do not over-cinch cables.

3.10 IDENTIFICATION

A. Refer to section 27 0553 for labeling details.

END OF SECTION

SECTION 27 0553
ADMINISTRATION & LABELING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Administration & Labeling for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 SUBMITTALS

A. Provide the following submittals:
   1. Product data
   2. Product samples
   3. Label sample showing example and text size for each item
   4. Software program sample

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Perform all Labeling.

PART 2 PRODUCTS

2.01 LABELS

A. All labels shall be vinyl.

B. All labels shall have an adhesive backing for permanent attachment.

C. All labels shall be of sufficient size. Minimum sizes shall be as follows:
   1. 1-1/2"W x 3/16"H for:
      a. Outlets
      b. Outlet cables
      c. Patch panels
      d. Ground wires
      e. Backbone cable pairs
   2. 4"W x 1"H for:
      a. Backbone cables
      b. Equipment racks
      c. MDF frames
      d. Active hardware and multiplexers
   3. 3” Square Tag mechanically stamped, legible, and permanent affixed. Tag shall be copper, brass, or 1/16” plastic.
      a. Cable Tray
      b. Riser Backbone Conduits
      c. Backbone Conduits

2.02 LABEL HOLDERS

A. Labels attached to backbone cable bundles shall be installed on a label holder of sufficient size. Label holder to be plastic and have tie wrapping provisions.

2.03 SOFTWARE PROGRAM

A. Software program shall be of the following types or similar:
   1. PANDUIT labeling program
   2. Brady labeling program
   3. Thomas & Betts labeling program
   4. Excel, customized

2.04 TEMPORARY LABELS

A. Vinyl labels, hand written, with permanent marker.

2.05 CHARTS

A. Provide printed charts containing required punch down and cross-connect information. Charts to be computer generated. File information shall be turned over to owner in printed and electronic format four (4) weeks prior to job completion.

2.06 AS-BUILT PLAN

A. Description: At the completion of the project, provide an "as-built" floor plan of each floor to the Project Engineer for approval.

PART 3 EXECUTION

3.01 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA/EIA-606 document, manufacturer's recommendations and best industry practices.

B. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels.

C. All labels shall be clear with black text.

D. All cables shall be labeled with machine generated, wrap around labels.

E. A total of three (3) labels per horizontal cable are required at the following intervals: 6" from outlet; 18" from outlet' 12" from termination block/patch panel.

F. Labeling scheme shall be alphanumeric.

G. Provide and generate all labeling (no labels will be furnished by the owner).

H. Labels shall be developed and printed using a software program.

I. Software program and all in-puts shall be turned over to the owner at the end of the project.

3.02 INSTALLATION

A. All labels shall be installed straight.

B. Provide labels at locations as indicated on the Drawings and as follows:
   1. Outlet face plates
   2. Inside of outlet boxes
   3. Outlet cable inside box
   4. Outlet cable in ceiling above outlet
   5. Outlet cables at poke through entrance on both sides
   6. Outlet cable at rear of patch panel.
   7. Port at rear of patch panel
   8. Port on front of patch panel
   9. Individual fiber strands at rear of patch panel
   10. Backbone cables & conduits whenever exposed on minimum 10' intervals

11. Backbone cable & conduit at point of termination
12. Ends of any cored cable put in place that is not terminated
13. On front of racks, cabinets frames, active hardware, multiplexers
14. Cable tray.

3.03 LABELING SCHEME

A. In general the following items shall receive labeling:
   1. Outlets:
      Top Label: Present Room–Telecom Room–Box Designation in Room. Ex: 112-119-3
      Bottom Label: Port Designation: D=Data Jack; T=Voice Jack – Ex. D1, D2, T1
   2. Outlet cables
   3. Backbone cables - (CVR=139) copper backbone to room 139, 1-25, 26-50, 51-75, etc - 200)
   4. Patch panels - (ex. PP#1, PP#2, etc)
   5. Patch panel ports (each) - Station room #, Box Designation in Room, Port Designation in Room. Ex – 112-3-4. Note – If Telecom Room serves 100 jacks, labels would start at 001 and go to 100.
   6. Equipment racks and cabinets - (EX. Rack 1, rack 2, etc)
   7. Ground wires
   8. Active hardware and multiplexers (by owner)
      Note – Contractor to obtain approval from owner/engineer before beginning labeling task.

B. Patch Panel labeling strip colors:
   1. Voice patch panels shall have port labels in “light blue” strips.
   2. Data patch panels shall have port labels in yellow” strips.

3.04 TEMPORARY LABELS

A. Provide temporary labels on all outlet cable as it is roughed-in. The bid documents will not show outlet/cable labeling at the time of the cable rough-in. Replace temporary labels with permanent labels after contract documents have been revised.

3.05 TEXT SIZE AND INFORMATION

A. Text size should be as large and as bold as possible.

B. Exact text required information is shown on the Drawings.

C. Refer to Drawings for all outlet, outlet cables, and backbone cables labels.

D. Refer to the Cover Drawing for exact labeling coding schemes, where applicable.

3.06 LABELING AND REFERENCE CHARTS

A. Contractor to provide a labeling reference chart(s) indicating the following:
   1. Backbone termination of pairs at the local telecommunication room (TR) and main telecommunications room (MR).
   2. Horizontal outlet cable pair termination at the TR.
   3. Data patch panel outlet port termination.

3.07 AS-BUILT PLAN & FRAME

A. Provide and mount frame with "as-built" on TR wall near the data racks, or as indicated on the plans.

END OF SECTION

SECTION 27 0800
COMMUNICATIONS COMMISSIONING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Perform all Copper Cabling Testing.
   2. Provide all Documentation, As-Builts, Training and Warranty.

PART 2 TESTING

2.01 TESTING REQUIREMENTS

A. General
   1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B.1-3. All pairs/strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors/strands in all cables installed.

B. Copper Testing
   1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category 6 & 6A performance. Horizontal balanced twisted pair cabling shall be tested using a level III test unit for category 6 compliance (data) and category 6A compliance (Wi-Fi) and performance up to 500 MHz.
   2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
   3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B.1-3 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the RFP and/or Drawings. These tests also include continuity checking of each fiber.
2. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-7 and/or ANSI/TIA/EIA-526-14 Standards, and to the manufacturer's application guides.
3. Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.
4. Multimode - Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter / light source. Fiber must be tested at both 850nm and 1300nm. Maximum attenuation dB/Km @ 850nm/1300nm shall be 3.5/1.5. Maximum attenuation per connector pair shall be .75 dB.
5. Singlemode - Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter / light source. Fiber must be tested at both 1310nm and 1550nm. Maximum attenuation dB/Km @ 1310nm/1550nm shall be 0.5/0.5 for outside plant and 1.0/1.0 for inside plant. Maximum attenuation per connector pair shall be .75 dB.

D. Test Results
1. Test documentation shall be provided on disk as part of the as-built package. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-B.1-3.
3. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. Alternately, the contractor may furnish this information in electronic form (CD). These diskettes or CDs shall contain the electronic equivalent of the test results as defined by the bid specification and be of a format readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.01 DOCUMENTATION & AS-BUILTS

A. As-Built record documentation for telecommunications work shall include:
Cable routing and identification
System function diagrams
Manufacturers' description literature for equipment
Connection and programming schedules as appropriate
Equipment material list including quantities
Spare parts list with quantities
Details not on original Contract Documents
Test Results
Warranties
Release of Liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract Drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of Telecommunications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Engineer for review and approval. As-built drawings shall be generated in AutoCAD 2015 or later. Submit as-built drawings electronically on C.D. and hard copy.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.
   1. Operations manuals for components and for systems as a whole.
   2. Maintenance manuals for components and for system as a whole.
   3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details.
   4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
   5. Emergency instructions for operational and maintenance requirements.
   6. Delivery time frame for replacement of component parts from suppliers.
   7. Recommended inspection schedule and procedures for components and for system as a whole.
   8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
   9. Complete "Reviewed" shop drawings and product data for components and system as a whole.
   10. Troubleshooting procedures for each system and for each major system component.

3.03 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

3.04 WARRANTY

A. General
   1. All equipment is to be new and warranted free of faulty workmanship and damage.
   2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the owner.
   3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Structured Cabling

1. Low voltage contractor shall provide a 25-year manufacturer warranty for components used in the installed Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Pathway & Support Infrastructure

1. Manufacturer(s) shall provide a 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION

SECTION 27 1100
EQUIPMENT ROOM COMPONENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cabinets, Racks & Enclosures.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of telecommunications equipment and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 SUBMITTALS

A. Provide product data.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Equipment Cabinets.
   2. Furnish and install all Equipment Shelves.
   3. Furnish and install all Backboards.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Standard Equipment Rack manufacturer(s):
   1. CPI
   2. Approved Equal

B. Equipment Cabinets
   1. See drawings for requirements.

C. Cable Guides
   1. Between patch panels - (front & back channels)
   2. Between racks - (front & back channels)

PART 3 - EXECUTION

3.01 EQUIPMENT RACKS/CABINETS/SHELVES

A. Equipment racks shall be securely attached to the concrete floor using four (4) 1/2" diameter bolts and associated hardware (anchors & washers) or as required by local codes.

B. Equipment racks/cabinets/shelves shall be installed as per the requirements specified by the manufacturer's installation guidelines.

C. Equipment racks/cabinets shall be placed with a minimum clearance of 30 inches in the front and 30 inches in the rear or as indicated on Drawings.

D. All equipment racks/cabinets shall be grounded to the telecommunications ground bus bar.

E. Mounting screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

3.02 BACKBOARDS

A. Backboards shall be 3/4" void free plywood. Size of backboard shall be 8' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint (Additive Acceptable).

3.03 IDENTIFICATION

A. Refer to section 27 0553 for labeling details.

END OF SECTION

SECTION 27 1116
COMMUNICATIONS FACEPLATES & CONNECTORS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates & Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of horizontal cabling and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 SUBMITTALS

A. Provide the following submittals:
   1. Product data
   2. Sample of each outlet correctly configured.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Copper Connectivity.
   2. Furnish and install all Faceplates.
   3. Furnish and install all Surface Mount Boxes.

PART 2 - PRODUCTS

2.01 COPPER CONNECTIVITY

A. Data Horizontal Module
   1. The horizontal module shall accommodate up to four (4) Category 6, 8-position, 8-contact modular jacks.
      a. Each jack shall be power sum rated, with a power sum NEXT performance equal to or better than the ANSI/TIA/EIA-568-C-2 Category 6 pair-to-pair NEXT performance specifications.
      b. Each jack shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
      c. The connector module shall be designed for use at the Work Area, Telecommunications Room and/or Equipment Room without modification.
      d. Each jack shall be T568B wiring configuration.
      e. Each jack shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
      f. Jack colors shall be confirmed by the owner. Unique jack colors shall be required for voice, data, spare and wireless access point outlets.

B. Wireless Data Module - For Category 6A wireless access point circuits, the horizontal module shall accommodate up to four (4) Category 6a, 8-position, 8-contact modular jacks.

1. Each jack shall be power sum rated, with a power sum NEXT performance equal to or better than the ANSI/TIA/EIA-568-C.2 Category 6A pair-to-pair NEXT performance specifications.
2. Each jack shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
3. The connector module shall be designed for use at the Work Area, Telecommunications Room and/or Equipment Room without modification.
4. Each jack shall be T568B wiring configuration.
5. Each jack shall have an insulation displacement connection featuring insulation slicing of 23 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
6. Jack colors shall be confirmed by the owner. Unique jack colors shall be required for voice, data, spare and wireless access point outlets.

C. F-connectors shall be By Thomas & Betts and of the “Snap N Seal” type model.

2.02 **FACEPLATES**

A. Faceplates – Straight-Type
1. The faceplate housing the connector modules shall have no visible mounting screws.
2. It shall be possible to install the connector modules in wall-mounted single-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
3. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
4. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows to facilitate outlet identification and ease network management.
5. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present of future network needs.
6. Blank inserts shall be used on faceplates for all unused ports.

2.03 **SURFACE MOUNT BOXES**

A. The surface mount box shall accommodate horizontal and video connections.

B. The surface mount box shall have internal storage space for slack cabling and a built-in spool for controlling cable bend radius.

C. Color shall be white.

PART 3 - EXECUTION

3.01 COPPER CONNECTIVITY

A. 8-position, 8-contact modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

3.02 FACEPLATES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.

C. Faceplates shall be installed straight and level.

D. Faceplates shall be installed at heights as noted on the Drawings.

3.03 SURFACE MOUNT BOXES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.

C. Surface mount boxes shall be installed straight and level.

D. Surface mount shall be installed at heights as noted on the Drawings.

3.04 IDENTIFICATION

A. Refer to section 27 0553 for labeling details.

END OF SECTION

SECTION 27 11 19
COMMUNICATION SYSTEM TERMINATION BLOCKS & PATCH PANELS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Termination Blocks & Patch Panels.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of telecommunications equipment and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 SUBMITTALS

A. Product data

B. One (1) sample of each

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Patch Panels.
   2. Furnish and install all Optical Fiber Enclosures.
   3. Furnish and install all Termination Blocks.

PART 2 PRODUCTS

2.01 PATCH PANELS

A. 24-Port, Category 6 Patch Panel – Data & Voice
   1. The Category 6 patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
   2. The Category 6 patch panel shall be equipped with 8-position modular ports and shall allow for termination of the T568B wiring scheme.
   3. The Category 6 patch panel shall be equipped with front labeling space to facilitate port identification.
   4. The Category 6 patch panel shall be power sum rated, with a power sum NEXT performance equal to or better than ANSI/TIA/EIA-568-B-1 Category 6 pair-to-pair NEXT performance specifications.
   5. Category 6 patch panels shall be used to terminate horizontal cables.

B. 24-Port, Category 6A Patch Panel – Wireless Data
   1. The Category 6A patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
   2. The Category 6A patch panel shall be equipped with 8-position modular ports and shall allow for termination of the T568B wiring scheme.
   3. The Category 6A patch panel shall be equipped with front labeling space to facilitate port identification.
   4. The Category 6A patch panel shall be power sum rated, with a power sum NEXT performance equal to or better than ANSI/TIA/EIA-568-C.2 Category 6A pair-to-pair NEXT performance specifications.

5. Category 6A patch panels shall be used to terminate horizontal cables.

C. USOC Voice Patch Panel
1. The USOC patch panel shall have RJ45 jacks wired USOC (only pins 4 & 5).
2. Back of panel shall have 50-pin female Amphenol connectors.
3. The appropriate number of patch panels shall be provided to accommodate termination of all horizontal Category 6 cables.

2.02 **VOICE BLOCKS**

A. 66M1-50 type punch-down blocks:
1. The appropriate number of 66M1-50 type connector blocks shall be provided to accommodate termination of all Service Provider RJ21X, PBX station blocks, backbone cables and USOC patch panels.
2. All 66M1-50 shall be “split” type with dual 50-pin female Amphenol connectors.
3. Blocks are to be mounted on stand-offs and blue metal backboards.

B. Protector voice blocks – 66 Type:
1. The appropriate number of protector voice blocks shall be provided to accommodate termination of all backbone cables between building 2 and building 1.
2. Shall be provided with dust cover for protector modules and cross connect blocks.
3. Shall be stackable to allow future service expansion.
4. External ground connector shall accept 6-14AWG ground wire.
5. Shall accommodate industry standard 5 pin protection module.
6. Shall meet or exceed UL497.

PART 3 EXECUTION

3.01 PATCH PANELS

A. Cables shall be dressed and terminated into patch panel ports that are organized in room number and outlet number order segregated by color of jack.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective patch panel. Each patch panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support straps. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 IDENTIFICATION

A. Refer to section 27 0553 for labeling details.

END OF SECTION

SECTION 27 1126
COMMUNICATIONS RACK MOUNTED POWER STRIPS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Rack Mounted Power Strips.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of telecommunications equipment and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

D. Provide one (1) power strip for each equipment rack. See rack elevation drawings.

1.02 SUBMITTALS

A. Provide product data

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Power Strips.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Power Strip manufacturer(s):
   1. Chatsworth Products, Inc.
   2. Ditek
   3. Geist
   4. ITW Linx

2.02 POWER STRIPS

A. Power Strip
   1. The power strip shall be equipped with a minimum of six (6) 3-prong, 120 VAC outlets, 6' cord and an on/off switch. Outlets shall accept side pole neutral plugs.
   2. The power strip shall be equipped with surge protection with a 20 Amp current limit.
   3. The power strip shall be equipped with a bracket that enables it to be mounted on a 19" rack, cabinet or wall mount bracket without modification.
   4. Power strips shall be managed.

PART 3 EXECUTION

3.01 POWER STRIPS

A. Power strips shall be installed as per the requirements specified by the manufacturer's installation guidelines.

B. See Drawings for installation location on rack(s)/cabinet(s).

3.02 IDENTIFICATION

A. Refer to section 27 0553 for labeling details.

END OF SECTION

SECTION 27 13 00
COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Pathways.
   2. UTP cable.
   3. Cable connecting hardware, patch panels, and cross-connects.
   4. Cabling identification products.

1.03 DEFINITIONS

A. Retain definition(s) remaining after this Section has been edited.
B. BICSI: Building Industry Consulting Service International.
C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
D. EMI: Electromagnetic interference.
E. IDC: Insulation displacement connector.
F. LAN: Local area network.
G. RCDD: Registered Communications Distribution Designer.
H. UTP: Unshielded twisted pair.

1.04 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between Telecommunications rooms in the telecommunications cabling system structures. Cabling system consists of backbone cables, intermediate and main cross-connects mechanical terminations, and patch cables or jumpers used for backbone-to-backbone cross-connection.
B. Backbone cabling cross-connects shall be located in Telecommunications rooms. Bridged taps and splitters shall not be used as part of backbone cabling.

1.05 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in ANSI/TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.06 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration drawings and printouts.
   4. Cabling diagrams to show typical cabling schematics including the following:
      a. Cross-connects.
      b. Patch panels.
      c. Patch cables.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
6. Ladder rack layout, showing ladder rack route to scale, with relationship between the rack 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 ladder racks.
   c. Vertical elevation of ladder racks above the floor or bottom of ceiling structure.
   d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for rack and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
D. Source quality-control reports.
E. Field quality-control reports.
F. Maintenance Data: For splices and connectors to include in maintenance manuals.
G. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E-84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 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 optical loss test set.
   2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including 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.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install 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. Polyvinyl floor tile shall be in place prior to mounting systems to the floor.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's Representatives and University.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Patch-Panel Units: 10% of each type.
   2. Connectors and covers: 10% of each type.

PART 2 PRODUCTS

2.01 **OPTICAL FIBER BACKBONE CABLE (OUTSIDE PLANT)**

A. Outside plant 8.3/125-micron Single-Mode Optical Fiber Non Conductive loose tube cable shall be designed for outdoor use. The loose tube cable shall be water-blocked to prevent water penetration.
   1. Generic Characteristics:
      a. The optical fiber cable shall have sequential length markings printed on the cable jacket.
      b. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure. Where spliced to existing cable plants, fusion splicing shall be required.
      c. Maximum cable attenuation dB/km @ 1310nm/1550nm: 0.65/0.50.
      d. All single mode fiber optic cable shall be laser optimized.

B. Outdoor Distribution 50/125 Multimode Optical Fiber Non-Conductive (OFNP) Tight Buffered Cable
   1. Generic Characteristics:
      a. The optical fiber cable shall be available with up to twelve 900-micron tight-buffered 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
      b. The optical fiber cable shall have sequential length marking printed on the cable jacket.
      c. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.0
      d. Bandwidth (RML-2000, OFL-1500) MHz-km @ 850 nm.
      e. Bandwidth 500 MHz-km @ 1300 nm.
      f. All multi-mode fiber optic cable shall be laser optimized, “OM-3” rated.
      g. Cable routed in conduit in grade slab or below grade shall be Outside Plant – Wet Rated.

2.02 **OPTICAL FIBER PATCH CABLES**

A. Patch cords shall be factory assembled duplex cable assemblies consisting of flexible optical fiber cable. Optical fiber shall be the same type as used elsewhere in the system. Patch cords shall be complete assemblies from manufacturer's standard product lines.

B. Patch cords shall be LC-SC duplex multi-mode, 3 meters length & LC-SC Duplex single-mode, 3 meter length. See one-line diagrams for patch cord requirements.

2.03 **OUTSIDE PLANT FIBER OPTIC SPLICE ENCLOSURES**

A. The optical splice enclosures shall be utilized in exterior handholes and shall be designed for through, branch, or mid-span type splice locations.

B. Splice enclosures shall be rated for underground or direct-buried applications.

C. Unit shall be equipped to handle 60 single-fiber splices.

2.04 **OPTICAL FIBER CONNECTORS**

A. Multimode Fiber Connectivity
   1. The optical fiber field-installable connector shall be SC format, for installation onto multimode 50/125-micron fiber.
   2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers or 250-micron loose-tube fibers.
   3. The optical fiber field-installable connector shall have a maximum Loss of .5 dB.
   4. The optical fiber field-installable connector shall have a typical Reflectance of -30 dB.

B. Singlemode Fiber Connectivity:
   1. The optical fiber field-installable connector shall be SC format, for installation onto singlemode 8.3/125-micron fiber.
   2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers or 250-micron loose-tube fibers.
   3. The preferred method of terminating loose-tube singlemode fiber is pigtail splicing into a rack mounted optical fiber panel or wall-mounted enclosure. Pigtails shall be factory terminated and 3 meters in length. A fiber enclosure with slack storage trays must be used when pigtail-splicing method is used.
   4. The splice loss through each connector pair shall not exceed 0.50 dB.
   5. All singlemode connectors (pigtails and field terminated) shall be SC.

PART 3 - EXECUTION

3.01 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service entrance facilities provider.

3.02 CABING METHODS

A. Cabling Method: Install cables in raceways and ladder racks except within equipment racks and cabinets. Conceal raceway and cables except in unfinished spaces.
   1. Comply with requirements for raceways and boxes specified in Division 27.

B. Cabling Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Cabling within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.03 INSTALLATION OF CABLES

A. Comply with NECA 1

B. General Requirements for Cabling:
   1. Comply with ANSI/TIA/EIA-568-B.1.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

4. Cables shall not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
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. Use 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 de-reeling. Heat lamps shall not be used for heating.
   In the communications equipment room, install a 25-foot- long service loop on each end of cable.
9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

Comply with the State of Georgia Telecommunications Design Manual.

C. UTP Cable Installation:
   1. Comply with ANSI/TIA/EIA-568-B.2.
   2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
   3. Do not remove more than 1/2 inch of the outer jacket.
D. Optical Fiber Cable Installation:
   1. Comply with ANSI/TIA/EIA-568-B.3.
   2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
E. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
F. Group connecting hardware for cables into separate logical fields.
G. Separation from EMI Sources:
   1. Comply with BICSI TDMM and ANSI/TIA/EIA-569-B 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 Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 12 inches.

3.04 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Through-Penetration Firestop Systems." Comply with ANSI/TIA/EIA-569-B, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.05 IDENTIFICATION

A. Identify system components, cabling, and cabling complying with ANSI/TIA/EIA-606-A. Comply with requirements for identification specified.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about ANSI/TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA/EIA-606-A.

C. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

D. Cable Schedule: Install in a prominent location in each equipment room and cabling closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:
   1. Label each cable within 6 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number cabling conductors connected to terminal strips and identify each cable or cabling group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
      b. Label each unit and field within distribution racks and frames.
   4. Identification within Connector Fields in Equipment Rooms and Cabling Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA/EIA 606-A, for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA/EIA-568-B.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cables, and labeling of components.
   3. Retain first subparagraph below if verification of quality is to be performed before completing horizontal cabling. Otherwise, specify testing of the transmission performance of cabling system in Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
   4. Test UTP copper 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.
      a. Test instruments shall meet or exceed applicable requirements in ANSI/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 cables and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.07 WARRANTY

A. The Structured Cabling System shall carry a manufacturer's 25 year product, labor and applications assurance warranty. Manufacturer and University shall perform an end-to-end audit on infrastructure prior to releasing warranty.

END OF SECTION

SECTION 27 1500
COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Structured Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of horizontal cabling and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.02 SUBMITTALS

A. Contractor shall provide submittals indicating the following:
   1. Cable description
   2. Use of cable
   3. Product data
   4. Specifications outlining cable
   5. Testing and qualification data
   6. Samples, approximately 12” in length

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Horizontal Copper Cable.

PART 2 PRODUCTS

2.01 HORIZONTAL DATA & VOICE COPPER CABLE

A. CATEGORY 6 BALANCED TWISTED PAIR CABLE – VOICE & DATA
   1. Description: 100-ohm, 4-pair UTP, 350 MHz certified cable, covered with a **Blue** thermoplastic jacket or as directed by the Owner Representative.
   2. Comply with ICEA S-90-661 for mechanical properties.
   3. Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.
   4. Comply with ANSI/TIA/EIA-568-B.2, Category 6.
   5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types: Communications, Plenum Rated: Type CMP.

B. CATEGORY 6A BALANCED TWISTED PAIR CABLE – WIRELESS DATA
   1. Description: 100-ohm, 4-pair UTP, 500 MHz certified cable, covered with a **Blue** thermoplastic jacket or as directed by the Owner Representative.
   2. Comply with ICEA S-90-661 for mechanical properties.
   3. Comply with ANSI/TIA/EIA-568-C.2 for performance specifications.
   2. Comply with ANSI/TIA/EIA-568-C.2, Category 6A.

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types: Communications, Plenum Rated: Type CMP.

2.02 COPPER PATCH CABLES

A. Reference one-line diagrams for patch cable quantities and locations.

B. Patch cables shall be approximately 1 meter in length. Cable used for the construction of patch cables shall be UL or ETL verified to meet Category 6 requirements and the cable jacket shall be labeled to indicate verification.

C. Provide the follow:
   1. One RJ45 to RJ45 blue jacketed Cat 6 patch cable for each data patch panel port.
   2. One RJ45 to RJ45 white jacketed Panduit Cat 6 patch cable for each white patch panel port.
   3. One set of two factory made fiber patch cords of a length and type to be specified by the owner (typically 3 meter Single Mode and Multimode SC-LC) for each fiber run.
   4. Three (3) 500’ spools of pair one, 24AWG, cross connect wire for the entire project.

PART 3 EXECUTION

3.01 HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

G. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

H. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

I. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

J. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

K. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.2 document, manufacturer's recommendations and best industry practices.

L. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely

coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

M. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

N. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support straps. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

O. When creating service loops for copper cables, they should be coiled in a Figure-eight configuration to eliminate adding to the problems of Return Loss and NEXT.

3.02 IDENTIFICATION

A. Refer to section 27 0553 for labeling details.

END OF SECTION

SECTION 275100
VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Specifications, Standards and Codes
   1. All work shall be in accordance with the following codes (specific editions defined by state or local authorities):
      a) The National Electrical Code (NFPA 70) with any applicable State Amendments.
      b) The International Building Code with Amendments.
      c) The Life Safety Code (NFPA 101).
      d) The National Electrical Safety Code (ANSI C-2).
      e) Americans with Disabilities Act (ADA)
      f) Local city and county ordinances governing electrical work.
   2. In the event of conflicts, the more stringent provisions shall apply.

1.02 DESCRIPTION

A. This section includes furnishing and installing all materials and providing all labor and supervision pertaining to the installation of an IP Video Surveillance System.
B. The requirements of the Security Surveillance System shall include all raceway, cabling, and equipment required to provide a fully functional system. Provide all labor, materials, equipment and supervision to install, check out, adjust, and calibrate the total system. Reference contract drawings for complete requirements.
C. The requirements of the Video Surveillance System shall include all power supplies, proper sizing of power conductors, connection to electrical panels for power circuits, conduit for power circuits and step down transformers as necessary for complete and fully operational system.
D. This division of the Specifications covers the complete Video Surveillance system as indicated on the Drawings and specified herein. The contractor shall provide all labor, materials, equipment, and supervision to install the specified system. The installation of all equipment shall be the full responsibility of the Security Surveillance Contractor for this project.
E. As part of the scope of this contract, the contractor shall configure client monitoring software on Owner provided monitoring station. The monitoring post shall be able to view all respective cameras. Coordinate with the Owner for location of monitoring station(s).
F. The Contractor shall be responsible for configuring the IP Address for the Network Video Recorders (NVRs), servers, workstations, cameras and any other components that are installed as part of this project. The Contractor shall coordinate with I.T. for provision of IP addresses.
G. A minimum of one (1) CD with client monitoring software and one (1) Operating Instruction Manual (for the software) must be provided for THE Clubhouse Building. Additional copies of client monitoring software with loading and operating instructions on CD must be available upon Owner's request at no charge for the duration of the warranty period.
H. All conflicts between the drawings and specifications shall be brought to the attention of the owner as soon as possible. In general, specification requirements shall take precedence over drawing requirements.

1.03 INSTALLER'S QUALIFICATIONS:

A. Firm with at least 5 years of successful application, installation, and testing experience on specified systems and equipment. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electric trade staff shall not be used for the installation of the Video Surveillance System and associated hardware. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified equipment.
B. Video Surveillance Contractor must be a certified installer of the manufacturer of the specified NVR and Network Video Monitoring Software (NVMS).
C. The Contractor must be licensed to perform Low Voltage/Telecommunications installations.
D. The responsibilities of the Video Surveillance Contractor shall include but not be limited to the following:
   1. Shop drawings on all Video Surveillance Systems and equipment.

2. Installation of all new Video Surveillance Systems and equipment as documented in the drawings and specifications.
3. Wire and wiring termination for all Video Surveillance and control systems and equipment.
4. Testing and check-out of all Video Surveillance systems and equipment.
5. Training for all Video Surveillance systems and equipment.
6. Warranty for all Video Surveillance systems and equipment.
7. As-Built drawings, operations and maintenance manuals for the complete Video Surveillance System.

1.04 RELATED DOCUMENTS

A. Contract drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section and shall be considered a part of this section and shall have the same force as if specified herein full.

1.05 SUBMITTALS

A. Within 30 days of notice to proceed, contractor shall deliver all required submittals.
B. All submittals shall be prepared in a line by line format corresponding to these specifications and shall indicate compliance with each requirement specified herein and indicated in the contract drawings.
C. Contractor shall complete the equipment submittal form (see last page of this specification) and attach to each item submitted. Awarded contractor may request the equipment submittal form in word format.
D. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of system equipment.
E. Shop Drawings: Submit shop drawings that contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been fully coordinated and will function properly as a system. All drawings shall be produced with Autodesk AutoCAD compatible with version 2012 or later. All floor plans, large scales and elevations are to be scaled. Drawings shall include but not be limited to the following:
   1. Site plan layout identifying all exterior mounted devices, outdoor / underground cable routing.
   2. Floor plan layouts showing device, equipment locations and cable / conduit routing.
   3. Functional one line diagrams showing all devices and cable infrastructure.
   4. Equipment rack / cabinet details and elevations identifying sizes and type. Identify equipment placement in equipment racks / cabinets and enclosures.
   5. Elevations for wall mounted equipment racks, cabinets and enclosures.
   6. Device mounting details identifying mounting procedures / requirements.
F. Contractor is responsible to maintain a full size set of drawings on site throughout the project. These drawings shall be updated daily identifying installation progress and any changes to work.
G. Test Plan: Contractor shall submit a test plan that defines the tests required to ensure that the system meets technical, operational, and performance specifications. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedure for evaluation and documentation of the results.
H. It is the responsibility of the contractor to meet with the appropriate Owner’s representative to compare the placement and installation of proper devices with the drawings and specifications. A 100% device by device test will be conducted by the vendor under the supervision of the Architect / Engineer representative. Punch lists will be developed at that time and furnished to the contractor. All punch list items must be corrected and verified prior to acceptance of the system

1.06 CONTRACT DRAWINGS

A. The Contract Drawings indicate the arrangement of Video Surveillance equipment. Coordinate installation of equipment with the structural, mechanical and electrical equipment and access thereto.

B. Raceway home runs as shown on the security and Security Surveillance System shall be installed as shown on the Drawings, and as required by the associated equipment manufacturers.
C. All raceways required for the Security Surveillance System are not shown on the Contract Drawings. It shall be the responsibility of the Contractor to provide raceway fit for the application and sized to meet all NEC requirements.

1.07 RECORD DRAWINGS (AS-BUILTS)

A. Contractor shall submit as-built / record documentation for approval 30 days prior to final inspection. Provide three (3) sets of complete data on the video surveillance system equipment used in this project. This data shall be in bound form and shall include all shop drawings on 11 x 17 tri-folded. Provide three (3) copies of the Operation and Maintenance Manuals including any equipment provided under this contract that can be operated or maintained by the customer.
B. All record drawings shall include "as built" system interconnection diagrams with major components identified by manufacturer and part number and the system wiring identified by number and type of interconnecting conductors. As-built drawings are to show wiring for all installed equipment. Head end equipment details shall be included with wiring interconnection properly identified as the system has been installed. Three (3) sets of full size (30"x42") As-built drawings must be provided. Corrected point-to-point drawings for all systems to show the actual as-built conditions. Original content from the contract documents (key notes, one-lines, device details) will not be accepted.
C. The As-built drawings must be provided with the Contractor’s title block on all sheets identifying the installation company and the project specific details.
D. All drawings shall be produced with Autodesk AutoCAD compatible with version 20012. Provide two (2) CD/DVD with all drawings in electronic format.
E. Provide a Warranty Letter in each O&M Manual Binder (2 copies total).
F. Provide two (2) copies on DVD of the training session. Manufactures training CD’s will not be accepted in place of recorded training sessions at the facility.
G. Document and provide two (2) copies of network configuration (such as a list of IP addresses and the devices the addresses belong to, line diagram demonstrating network topology, etc.).
H. The final pay application will not be approved until the post final inspection is completed, all Construction Observation items have been satisfied, and all of the above requirements for record documents are submitted and approved.

1.08 ACCEPTABLE MANUFACTURERS

A. Reference products section of specifications for acceptable manufacturers.

1.09 WARRANTY

A. The contractor shall warrant the Video Surveillance System for one year from date of start-up against defects in equipment or workmanship. Failed equipment shall be replaced by the contractor at no cost to the owner. Owner's personnel may perform initial trouble investigation but replacement of failed equipment and escalated problem support will be handled by the contractor.
B. The Contractor shall provide a Warranty Letter indicating the start date of the warranty. The Warranty Letter shall also provide contact information (Company name, Service Supervisor’s name and phone numbers for normal working hours and Emergency Service request). The warranty period will not start until Warranty Letter has been reviewed, approved and agreed upon by the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials or equipment specified by manufacturer's name shall be provided, unless approval of other manufacturers is listed in addendum to these Specifications. Any materials or equipment approved in addendum shall function the same as the equipment specified.

2.02 VIDEO SURVEILLANCE CAMERAS

A. All cameras shall be U.L. listed and shall be the standard product of one manufacturer complying with not less than the specifications contained herein. Installation of each camera shall in-

clude mounting brackets and/or camera housings fully compatible with the camera provided and as required by Security Surveillance System camera schedule.

B. All camera installations shall be securely attached to the mounting surface. Use lead shields on solid masonry, toggle bolts for hollow masonry, and machine bolts for steel. All anchoring devices shall be rated to support not less than five times the total equipment weight. Reference mounting details in contract documents.

C. Outdoor Fixed Dome, Wide Dynamic Range, 2 Megapixel Cameras:
   1. Basis of design is the Axis P3365-VE vandal and weather resistant, high security dome style camera.
   2. All cameras, in this category, shall be equipped with variable focal (3 to 9mm) lenses.
   3. It shall be the Security Contractor's responsibility to ensure that the latest version of firmware, that is compatible with the Video Management System, is downloaded to all cameras prior to Final Inspection.

D. Outdoor Fixed Bullet Camera, Wide Dynamic Range, 2 Megapixel Cameras:
   1. Basis of design is the Axis P1405-LE Outdoor ready bullet-style camera with built-in IR. IR shall be sized to meet view requirements.
   2. All cameras in this category shall be equipped with variable focal lenses (2.8~10mm).
   3. All cameras in this category shall be equipped with Day/Night function and Wide Dynamic Range.
   4. It shall be the Security Contractor's responsibility to ensure that the latest version of firmware, that is compatible with the Video Management System, is downloaded to all cameras prior to Final Inspection.

E. Indoor & Outdoor Fixed Dome, Multi-Sensor, 9 Megapixel Cameras:
   1. In this category, cameras shall be equipped with multiple imagers or sensor. Each imager or sensor shall provide a 3 megapixel image.
   2. In this category, cameras shall be equipped with multiple imagers or sensor. Each imager or sensor must be equipped with a variable focal 2.8 – 8 mm lens.
   3. It shall be the Security Contractor's responsibility to ensure that the latest version of firmware, <u>that is compatible with the Video Management System</u>, is downloaded to all cameras prior to Final Inspection.

F. Network Specifications (All IP Cameras):
   1. Network: 100BASE-TX
   2. Cabling: CAT6
   3. Connector: RJ-45
   4. Security: SSL
   5. Protocols: UDP, TCP, SOAP, DHCP, Zeroconf

G. All cameras shall include a 36 month warranty.

A. Acceptable camera manufacturers shall be compatible with NVR & Video Management System.

<u>2.03</u> <u>CAMERA LENSES</u>

A. Camera lenses shall be compatible with the camera construction and iris control circuit. The lenses shall be compatible with remote control devices as specified herein. The lenses shall be supplied by the same camera manufacturer.

B. All lenses shall be auto iris type driven by the camera iris control circuit. Additionally, all exterior lenses shall be equipped with spot filters giving the lens a minimum effective aperture of f/360.

C. Lens size shall be as indicated on the drawings and/or camera schedule.

D. Acceptable manufacturers shall include Axis or approved equal.

<u>2.04</u> <u>CAMERA HOUSINGS AND SUPPORTS FOR FIXED CAMERAS</u>

A. All camera housings and support brackets shall be compatible with camera specified herein. Housings shall be provided with cable entrance facilities for camera control and power and shall be adaptable to mounting devices used with cameras. All mounts shall be "Feed Through" type to ensure that power, signal, and data cables are concealed. All camera housings and support brackets shall be securely attached to mounting surfaces. Escutcheon plates attached with security screws shall be used to conceal holes in walls or ceilings. Manufacturer guidelines for

mounting devices and support brackets shall be adhered with unless contract details exceed manufacturer guidelines.

B. The camera housings or unitized camera housing assemblies must incorporate the following as a minimum:
   1. Mounting hardware with security screws that allow access into the camera housings or units with only special tools.
   2. Impact resistant domes or viewing ports.
   3. Cable routing for power and video signal routed through the mount or back of the camera so that no cable is exposed after the installation.

C. Exterior Housing: Housings shall be medium-sized “Dome” environmental housings designed for wall mount applications. Domes shall be rated as vandal proof, impact resistant type. Housing shall be provided with mounting hardware. An internally mounted thermostatically-controlled heater-defogger shall be provided. Liquid-tight fittings shall be used for cable routing. All exterior housings shall be provided with tamper resistant kit, and mounting hardware. Reference manufacturer guidelines for mounting requirements.

D. Interior Domes: All mini-dome style cameras, installed in lay-in tile ceilings, shall be supported by Manufacturer approved mount or T-bar Support Kits.

E. Reference camera details and/or schedule for housing and mount types required.

F. Acceptable manufacturers shall include Axis or approved equal.

2.05 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

A. General:

   The Video Management System approved for this project is Johnson Controls Smartvue.

B. A software serial number shall be associated with the software and will support the pre-defined license configuration for the Smartvue model number. At any time, additional add-on features and SSA can be purchased for the Smartvue software license.

C. Number of online cameras or encoders based on IP address allowing for multi-sensor or multi-channel devices to occupy a single camera license.

D. On the Hybrid platforms, if an analog input is not used, then the unused channel can be upgraded to support an additional IP camera channel, with the purchase of additional camera license, up to the maximum number of channels supported by the specified Hybrid model.

E. Number of IP addresses of supported camera/encoder devices, up to the maximum number of purchased that can be supported by the specified recorder model platform. The license shall not be tied to individual camera or encoder MAC address to enable ability to easily add, remove or exchange devices.

F. Number of analytic video channels, up to the maximum number of purchased analytic channels supported by the specified recorder model platform. The license shall not be tied to individual camera or encoder MAC address to enable ability to easily add, remove or exchange devices.

G. Number of face verification video channels, up to the maximum number of purchased face verification channels supported by the specified recorder model platform. The license shall not be tied to individual camera or encoder MAC address to enable ability to easily add, remove or exchange devices.

H. Number of face recognition video channels, up to the maximum number of purchased face recognition channels supported by the specified recorder model platform. The license shall not be tied to individual camera or encoder MAC address to enable ability to easily add, remove or exchange devices.

I. Number of licensed camera devices, video analytic channels, face verification channels and/or face recognition channels shall be easily increased, and the license version can easily be updated. The online registration shall auto-generate the updated license for the applicable server and email the file.

J. SSA expiration email notifications shall be configurable.

K. The detailed license status shall be easily accessible and clearly stated in the Smartvue software interface.

L. Major software releases for the Smartvue will require an updated compatible license file. An automated online registration shall be available from the manufacturer to support generation of new or update licenses upon demand, and delivered electronically via email.

2.06 NVR STORAGE REQUIREMENTS

A. NVRs and any server-based storage for video shall be sized for a minimum of 30 days at full resolution, a minimum of 7 frames per second and 50% motion. Additionally, servers and storage units must be licensed and sized for the number of cameras plus 15% spare capacity. Furnish calculations with shop drawings verifying storage sizing in compliance with these specifications.

2.07 VIDEO STORAGE HARDWARE

A. The server hardware shall at a minimum meet the following:
   1. CPU: Intel Xeon E5-2620, 2.0GHz
   2. RAM: 8 GB DDR2
   3. Network Interface: Two (2) 1 Gbps Integrated NIC
   4. Hard drive: SATA-II 7200 RPM Enterprise Class Hard Drives, sized accordingly. Dedicated OS drive, minimum 500GB with 16M Cache Memory.

B. Acceptable manufacturers for NVR hardware are: Dell, HP, Seneca, Pivot3, or other approved equal.

2.08 GIGABIT POE ETHERNET NETWORK SWITCHES

A. Ethernet switches shall be U.L. listed and shall minimally meet with all regulatory agency approvals specifications as the recommended models (e.g. Safety Certifications, Electromagnetic Emission Certifications, NEBS).

B. All switches to be mounted in provided standard 19” racks.

C. All switches must support QOS. All switches should support minimally: IEEE 802.1p COS, and DSCP.

D. All switches shall support rate-limiting based on source/destination IP address, source/destination MAC address, or Layer 4 TCP/UDP information.

E. Additional standards that must be supported: IEEE 802.3ad, IEEE 802.1Q, 802.1D, 802.1x and 802.3af for Power over Ethernet switches (POE).

F. Specified manufacturers for Ethernet switches shall be Cisco Systems, Inc., HP or approved equal.

2.09 HORIZONTAL DATA & VOICE COPPER CABLE

A. CATEGORY 6 BALANCED TWISTED PAIR CABLE – VIDEO SURVEILLANCE
   1. Description: 100-ohm, 4-pair UTP, 350 MHz certified cable, covered with a **Yellow** thermoplastic jacket or as directed by the Owner Representative.
   2. Comply with ICEA S-90-661 for mechanical properties.
   3. Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.
   4. Comply with ANSI/TIA/EIA-568-B.2, Category 6.
   5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types: Communications, Plenum Rated: Type CMP.
   6. Reference Specifications Section 270100 – Communications General for manufacturer and warranty requirements.

2.010 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Furnish and install 1.2 KVA minimum uninterruptable power supply (UPS) at the location of the video surveillance head end equipment. UPS system to provide battery backup for a minimum of 30 minutes and be rack mounted in the active components system rack.
   The UPS shall be an on-line double conversion UPS which shall have the following minimum features:
   1. Audible Alarms
   2. Automatic Self Test
   3. Automatic Voltage Regulation (AVR)
   4. Building wiring fault indicator
   5. Hot Swap Batteries with Intelligent Battery Management
   6. Lightning and Surge Protection
   7. Line-interactive

8. Load Meter
9. Network-grade line conditioning
10. Overload Indicator
11. Rack Mount
12. Replace Battery Indicator
13. Sine-wave output
14. Status Indicator LED's
15. UPS shall have the ability to handle crest factor ratios of 2.5 or above.
16. UPS shall provide continuous (no-break power) during momentary or complete black-outs.
17. UPS shall have the ability to recharge the battery to 90 percent capacity within a reasonable period of time (5 to 10 times the discharge time).
18. The UPS output shall be regulated with maximum deviations from nominal of +6 percent to –13 percent over the full input range, both AC and DC.
19. UPS shall meet ANSI C84.1 requirements.

B. UPS and batteries shall be sized to 150% output VA required and shall be valve regulated (sealed or maintenance free) lead-acid cell type. Batteries shall be installed within the UPS enclosure or in a standard enclosure provided for that purpose by the UPS manufacturer.

C. Furnish calculations with shop drawings verifying UPS sizing in compliance with these specifications.

2.011 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

A. Protect all equipment against surges induced on all control, video, and power cables. All copper cables and conductors which serve as 120V power, control, or video conductors shall have surge protection circuits installed at each end and locations where conductors enter or exit a building. Fuses shall not be used for surge protection. On board surge suppression will not be acceptable. External surge suppression, as described in this section, is required.

B. Protect all devices mounted on the exterior of the building with surge suppression devices mounted at the device and grounded per manufacture's recommendations.

C. Surge suppression devices shall meet the following standards/publications:
   1. UL 497B
   2. UL 1449 (must meet 330 Volt suppression rating)
   3. IEEE Category B impulse and ring wave tests

D. Acceptable Manufacturers: Northern Technologies Inc., Ditek Corporation, and EDCO. Product shall be warranted against defect for a period of not less than five (5) years.

E. All power connections, including 24 VDC and 24 VAC power supplies and direct wired or plug-in 120 VAC power connections, for all systems and components specified herein, shall be equipped with surge suppression devices. Devices shall be bonded to building grounding system in accordance with Article 250 of the National Electric Code.

F. Grounding: Provide a dedicated, separate No. 6 AWG copper conductor from building grounding system to the video equipment room, video equipment cabinets, and central control room. Connect all lightning protection devices and video equipment non-current carrying metal parts to grounding conductor in accordance with Article 250 of the National Electric Code. Provide ground bus bar in equipment room and control room with dedicated ground conductor to each cabinet, enclosure, pull/junction box and all equipment.

G. Ground Resistance Measurement: Each signal ground system D.C. resistance shall be measured between any point on the signal ground bus and the earth ground. An instrument designed specifically to measure the resistance of a point to each earth ground shall be used. The systems subcontractor shall measure ground resistance in accordance with the procedure as outlined by the test equipment manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions, and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Penetrations in fire-rated construction shall be fire-stopped in accordance with specifications. Conduits and

raceways shall be installed in accordance with the National Electric Code (NEC). Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables. Metal conduits shall not be continuous between buildings. Contractor to provide ground isolation between buildings by breaking continuous copper cabling and metal conduit runs.

B. Equipment: All monitor support brackets shall be securely attached to mounting surfaces. Use lead shields on solid masonry, wood screws on wood, and machine bolts on structural steel. All anchoring devices shall be rated to support not less than five times the total equipment weight.

C. Surge Protection:
   1. All copper cables and conductors which serve as control, power, or data conductors shall have surge protection devices installed at each end that complies with electrical and security specifications.
   2. Protect all video and data equipment from surges induced on all control, power and data cables. All cooper cables and conductors which serve as control, power, or data conductors shall have surge protection circuits installed at each end that meet the IEEE 472 surge withstand capability test. Fuses shall not be used for surge protection.
   3. All low voltage cabling routed to exterior cameras not attached to the building structure, must be protected with TVSS surge suppression devices located at both the building penetration and at the device

D. Power:
   1. All interior and exterior fixed cameras shall be powered from centralized, UL Listed, low-voltage power supplies in the designated equipment rooms.
   2. 120 VAC power circuits utilized to power the cameras, power supplies and controls must be dedicated and un-switched.

E. At all exterior cameras, seal tight (flexible, vinyl coated, weatherproof, metallic raceway) conduit and fittings must be provided between the camera enclosure and exterior wall penetration and / or junction box. All exterior penetrations must be sealed.

F. All holes in ceilings and walls resulting from this project must be weather sealed and fireproofed by the Contractor.

3.02 TESTING

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

3.03 LABELING

A. Cable labeling:
   1. All cable and wire installed for Video Surveillance Systems shall be properly tagged. Use the following standard labeling scheme to identify the physical location of both ends of each cable.

      a. A100 –C1
      b. | |
      c. | Camera #: Use one number per cable.
      d. |
      e. Room number where camera is installed.

      f. Room Camera
      g. Number Number
      h. A100 C-1

      i. Format Example
      j. A100-C1

   2. Complete two (2) labels for each cable, one for each end. Secure label to end of cable, within view of the termination of the cable at each end. Labels shall be white with a protective

wrap-around plastic transparent cover that will serve to protect the ink from smearing and secure the label to the cable. All labels shall be typed with black ink.

3.04 TRAINING

A. The Contractor shall include in the base Contract all costs required to train operating and maintenance personnel in the use and maintenance of systems provided under this section of the Specifications. Training sessions shall be conducted by instructors certified in writing by the manufacturer of the specific system.

B. Sessions shall be conducted for not less than four hour periods during normal working hours, i.e., Monday through Friday, 8:00 AM to 5:00 PM. Training session schedules shall conform to the requirements of the owner; therefore such schedules shall be submitted to the owner for approval not less than two weeks prior to the training session. All training sessions shall be video-taped for future use. At the owner's discretion, provisions shall be made to allow up to 2 owner personnel to participate in final system check out of all systems.

C. Video tapes shall be of professional quality both for video and audio and must be approved by the Owner/User. Provide two copies to Owner/User. Time to be included in base Contracts for specific systems shall be as follows:

1. Video Surveillance System - 4 hours

END OF SECTION

SECTION 27 51 13
PAGING SYSTEMS

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Rome Tennis – Indoor Courts

B. Owner's Name: City of Rome.

C. Architect's Name: Menefee Architecture.

D. The Project consists of the construction of indoor tennis courts

1.02 DESCRIPTIONS

A. The work required under this section of the specifications consists of the furnishing, installation, and programming of independent Paging system for Rome Tennis Indoor Courts located at Rome, Georgia. Reference floor plan drawings for audio visual equipment locations. In addition to all audio-visual components, the contractor shall be required to provide coordination with the data infrastructure systems. Also, the contractor shall coordinate with the electrical contractors for all power receptacles to support the audio-visual systems.

B. The Audio-Visual scope of work will require the AV contractor to provide a complete, quality operating system which will display, playback, and route computer, video, and audio signals as well as control signals to each noted space of the building. A factory approved representative shall complete all applicable system connections. A factory approved and factory trained representative of the AV contractor shall complete all onsite programming of equipment.

C. **The Audio-Visual contractor shall provide all labor, materials, equipment, and supervision to install specified systems. The installation, testing, and commissioning of all equipment shall be the full responsibility of the Audio-Visual contractor for this project.**

1.03 QUALITY CRITERIA AND STANDARDS

A. The Audio-Visual wiring, devices, and equipment shall comply with applicable UL, NEC, and NEMA code standards. All Audio-Visual equipment shall be UL-listed and labeled.

B. Audio Visual wiring systems shall conform to established trade and industry standards. The following specifications and standards are incorporated into and become a part of this Specification by reference.
   1. AES14-1992 (r2004): – AES Standard for Professional Audio Equipment
   2. AES26-2001 – AES Recommended Practice for Professional Audio
   3. ICEA S-80-576 ICEA Standard for Communications Wire and Cable for Wiring of Premises
   4. NFPA 70 70 National Electric Code Work restrictions.
   5. UL 50 Enclosures for Electrical Equipment

C. All installers for Qualifications
   1. Firm with at least 3 years of successful application, installation, and testing experience on specified systems and equipment.
   2. The AV contractor must show proof of being in the Audio-Visual trade for a minimum of three years and provide three (3) references with contact names and telephone numbers regarding successful completion of Audio Visual projects of similar scope and size.
   3. All supervisors and installers assigned to the installation of this system or any of its installers assigned to the installation of this system or any of its components shall have components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. Unqualified staff shall not be used for the installation of the equipment, system cables, and associated hardware.

4. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years' experience in the installation of the specified Audio-Visual equipment and components.

1.04 SUBMITTALS

A. Product Data: Audio Visual contractor shall provide a numbered equipment list of the systems devices he is providing for approval by the owner's architect and engineer. The list shall include quantity of items, manufactures product number, description of item and Audio-Visual specification that it represents. Submit manufacturer's technical product technical data sheet for each item of systems equipment in order of the numbered equipment list. Submittal shall include documents that contain complete floor plans and reflected ceiling plans, wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function as a complete system. Documents shall include vertical riser diagrams, equipment rack details, elevation documents, connector faceplate details, sizes, and type of all cables and raceway.

B. Test Plan: AV Contractor shall submit a test plan to the owner's architect and engineer that defines the tests required to ensure that the system meets technical, operational, and performance specifications, 45 days prior to the proposed test date. The test plan must be approved by the owner's architect and engineer before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

1.05 WARRANTY

A. All equipment shall be new and shall be under warranty for a period of one (1) year, from the date of acceptance by the owner, against defects in equipment or workmanship. Failed equipment shall be replaced by the AV contractor at no cost to the owner. Owner's personnel may perform initial trouble investigation but replacement of failed equipment and escalated problem support will be handled by the AV contractor.

B. Owner intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal operations.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.06 ACCEPTABLE MANUFACTURES

A. Reference Part 2 – Product Section of the specification for complete list of acceptable manufactures.

1.07 RECORD DOCUMENTS

A. At the time of final inspection, provide three (3) sets of complete data on Audio Visual System equipment used in this project. This data shall be in bound form and shall include all shop documents required for this project.

B. All record documents shall include "as built" system interconnection diagrams with major components identified and number and type of interconnecting conductors.

C. Maintenance and operating Manufacturer's instructions on all systems.

D. Certification from system manufacturers that systems are installed in accordance with

E. Manufacturer's recommendations and are functioning correctly at the time of final inspection.

F. As-built documents to show raceway layout and wiring for all systems.

G. Corrected point-to-point documents for all systems with color code to show the actual as-built condition.

PART 2 PRODUCTS

2.01 GENERAL MATERIAL REQUIREMENTS

A. Provide all material indicated in the Itemized Equipment List included in the AV drawing set. Materials and equipment shall be the manufacturers' latest standard design that has been in satisfactory use for at least 1 year prior to installation. See Part 3 - Execution specification section for additional product requirements.

B. The Audio-Visual scope of work will require the AV contractor to provide a complete, quality operating system which will display, playback, and route computer, video, and audio signals as well as control signals to each noted space of the building. A factory-approved representative shall complete all system connections. A factory approved and factory trained representative of the AV contractor shall complete all onsite programming of equipment.

2.02 AUDIO DIGITAL SIGNAL PROCESSOR (DSP)

A. Audio Digital Signal Processor shall be rack mounted. All internal processing shall be digital (DSP). Software shall be provided for creating/connecting DSP system components within each hardware unit. Available system components shall include (but not be limited to) various forms of: mixers (including automatic), equalizers, filters, crossovers, dynamics/gain controls, routers, delays, remote controls, meters, generators, and diagnostics. Channels shall gate silently for system response and clarity. Ethernet communications shall be utilized for software control and configuration.

B. Audio Digital Signal Processor shall meet the following specifications:
   1. Inputs: minimum 12, electronically balanced, on plug-in barrier-strip connectors.
   2. Expandable Digital audio input and output capability Via AVB or Dante™ digital audio networking protocols.
   3. Digital Audio Connectivity shall support most current Dante™ Protocols.
   4. Outputs: Eight (standard), electronically balanced, on plug-in barrier-strip connectors.
   5. Additional Four Channels required. Obtain optional output card; Twelve Output Channels total.
   6. After initial programming, systems may be controlled using TCP/IP, USB, or RS-232 serial communication by third party control systems (such as Crestron), by PC computer, and/or by dedicated control devices.

C. Acceptable manufacturers include: Symetrix Radius 12x8 EX or comparable from BSS or Biamp.
   1. Package System shall include:
      a. (1) Symetrix 2 Line Analog Interface Card

2.03 MULTI-CHANNEL AUDIO AMPLIFIER

A. Amplifiers shall be rack mounted. Amplifiers shall be designed for use in a commercial sound re-enforcement application. Amplifiers shall contain circuit breaker for overload protection; high temperature automatic reset protection, and electronic output protection. Amplifier controls shall have on/off switch and pilot light, master gain control, signal input/output and input channel controls. Amplifiers shall not be loaded over 70% of the power output rating and shall be capable of power output ratings equivalent to or greater than the peak draw level of the associated speakers.

B. Multi-channel Amplifier shall meet the following specifications:
   1. Mounting: Rack mounted.
   2. Outputs: Both low impedance (4/8 ohms) and constant voltage (70/100V).
   3. Frequency Response: Within plus or minus 1 dB from 20 to 20,000 Hz.
   4. Minimum Signal-to-Noise Ratio: 100 dB, at rated output.
   5. Total Harmonic Distortion: Less than .3 percent at rated power output from 20 to 20,000 Hz.
   6. Power Draw at Idle: Less than 80 watts.

7. Controls/Indicators: On/off, input levels, selection of bridge mode for each pair of channels, high pass filter. Power on, signal presence, and clipping indicators.
8. Protection: Built-in circuits monitor both current and temperature.
9. Cooling: Fan cooled.

C. Acceptable manufacturers include: Lab Gruppen E series or comparable from Crown or QSC

2.04 WALL MOUNTED SPEAKER

A. Speakers shall be mounted on wall. Each speaker installation shall be complete, including, where applicable, matching transformers, mounting brackets/back boxes as per manufacturer's recommended construction compatible with the total system. Speakers shall be mounted as indicated in contract documents to provide optimum mid to near field coverage for presentation/source materials.

B. Wall Mounted Speaker shall meet the following specifications:

1. Dispersion: 120°
2. Low Frequency Cut Off: 115Hz
3. Air Column Length: 4-1/2"
4. Bell Size: 22" x 12"
5. Horn Length: 17"
6. Bracket: 8-3/4"

C. Package System shall include:
   a. (1) Atlas Sound PD-5VT Compression Diver

D. Acceptable manufacturers include: Atlas CJ-46 or Community, JBL equivalent.

2.05 TRANSIENT VOLTAGE SURGE SUPPESSION

A. Transient Voltage Surge Suppression devices shall be provided to protect power strips in each rack and all equipment. Transient voltage surge suppression shall be provided for all Audio-Visual equipment devices.

B. Transient voltage surge suppression devices shall be an industrial-grade surge suppressor with EMI/RFI filtering.

2.06 WIRING CONNECTORS

A. Audio Cables:
   1. Audio Cable 2 pair:
      a. Provide multi-pair shielded cable. Use two-pair cabling where two or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
      b. PVC outer Jacket.
      c. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
      d. Conductors to be 0.76mm nominal outer diameter.
      e. Acceptable Product: 1814R (9451DP where CMP rating required)
      f. Gepco GA61802GFC (or 6602HS where CMP is required)
   2. Analog Audio Cable single pair (Inner Rack Wiring):
      a. Provide for inner rack wiring.
      b. PVC outer jacket.
      c. Conductors to be 0.76mm nominal outer diameter.
      d. Acceptable product:
      e. Gepco 6180 EZ
      f. Belden 9451
      g. Clark Wire & Cable SPA22GS
      h. WestPenn 451

B. Speaker Cable:
   1. 70Volt Plenum Speaker Cable:
      a. Pairs: Single
      b. Conductors: Stranded tinned copper conductors, 18 AWG minimum, sized as required to limit wire loss to 0.5 dB.
      c. Jacket: PVC
      d. NEC Specification: CL2P
      e. Acceptable Product:
      f. Belden 6000UE series or comparable from West Penn.

C. HDMI Cable:
   1. Provide pre-molded cables in lengths required to dress neatly without coiled remainder.
   2. Acceptable Product:
      a. Extron Ultra-Flex HDMI Cable
      b. Crestron HDMI Cable
      c. As Approved

D. Augmented Category 6 Balanced Twisted Pair Cable:
   1. The horizontal balanced twisted pair cable to meet or exceed the Category 6A transmission characteristics per ANSI/TIA/EIA-568-C.

E. For balanced of A/V cables and connectors, reference one-line diagram in contract documents and provide appropriate cables and connectors to ensure a fully functional Audio-Visual System.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify that surfaces and conditions are ready to accept the work of this section. General System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions, and as shown. Necessary interconnections, services, and adjustments required for complete and operable Audio-Visual systems shall be provided. Components shall be labeled in accordance with TIA/EIA 606. Penetrations in fire-rated construction shall be fire-stopped. A/V cables shall not be installed in the same raceway with AC power cables. Cables not installed in conduit or wire ways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

B. Equipment Racks and Cabinets
   1. Open frame equipment racks shall be bolted to the floor slab. Cable guides shall be bolted or screwed to racks. Racks shall be installed level.

C. Rack Mounted Equipment
   1. Rack mounted equipment shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.02 GROUNDING / BONDING

A. System should follow the grounding requirements of the National Electrical Code (NEC). Frame of all metal equipment racks should be grounded.

3.03 TESTING AND CHECK-OUT

A. Testing requirements apply to all equipment. AV Contractor to test each Audio Visual component as recommended by manufacturer. Test methods and test results shall be submitted to the owner’s architect and engineer and approved prior to final inspection.

B. Materials and documentation to be furnished under this specification are subject to inspections and tests by the owner’s architect and engineer. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests

have been made, demonstrating that the Audio-Visual systems conform to the specified requirements, and that the required equipment, systems, and documentation have been provided.

C. Systems with Digital Signal Processors shall have the processor programmed for audio signal routing and control as required. AV Contractor to configure settings such as high pass filters according to typical best practices design. AV Contractor to equalize sound system using test equipment and methods that correspond to the sophistication of the system and the use of the space. Audio should retain a neutral sound quality without any emphasized frequencies or susceptibility to feedback.

3.04 TRAINING

A. The AV Contractor shall include in the base contract all costs required to train Owner's operating and maintenance personnel in the functionality, operation, use and maintenance of systems provided under this section of the Specifications.

B. Training sessions shall be conducted for User staff related to the functionality, operation, and maintenance of all equipment and systems furnished and installed under this contract. One training session, of about four hours duration, shall be conducted for staff as scheduled by the Owner. Another training session shall be conducted about one month after the initial training sessions if required by the Owner.

3.05 AS-BUILT DOCUMENTS AND /OR DOCUMENTATION:

A. As-built documents shall be provided noting the exact cable path and cable labeling information. Documents in .DWG format shall be provided by the AV contractor. As-builts shall be submitted to the owner on formatted CD's, saved as .DXF or .DWG files. Redline hardcopies shall be provided as well. CAD generated as-built information shall be shown on a new layer named AS-BUILT.

B. System Acceptance: Before the Owner accepts the system, the AV contractor shall be required to walk-through the installation with the Owner's representative and the design engineer to verify proper installation and operation. AV Contractor to provide digital audio signal processor files for review prior to final system inspection.

END OF SECTION

SECTION 283000
ELECTRONIC SECURITY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Contract drawings, specifications, and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.02 SUMMARY

A. This section of the specifications requires the complete installation of a new Access Control Systems (ACS). See floor plans for equipment locations. The ACS Systems shall be a distributed system, based upon the standard products of ACS System manufacturers using conventional network communication for information distribution.

B. The ACS systems shall be customized to meet the requirements of the Owner and system operators. The contractor shall be responsible for coordinating with the owner group in programming all ACS features and functions. Typical coordination items includes: User setup, card holder database, alarm messages, security schedules, video and intercom links, etc.

C. All electric door hardware is being provided and installed by the General Contractor (GC). The security contractor shall connect, power, and program all door hardware installed by the General Contractor. All door position switches shall be provided and installed by the security contractor.

D. The electronic security contractor shall be responsible for all cabling, hardware and miscellaneous equipment required to provide a fully functional residential Access Control System

1.03 ACCEPTABLE MANUFACTURERS

A. IDS equipment and systems conforming to this section of the specifications and manufactured by the following manufacturers shall be acceptable:
   1. Honeywell Security – Vista

B. ACS equipment and systems conforming to this section of the specifications and manufactured by the following manufacturers shall be acceptable:
   1. Honeywell Security – NetAXS
   2. Honeywell Security – Northern

1.04 QUALITY ASSURANCE

A. Industry Referenced Standards. The following specifications and standards are incorporated into and become a part of this Specification by reference.
   1. FCC compliance
   2. UL compliance
   3. NEC compliance
   4. IBC 2015

1.05 INSTALLER'S QUALIFICATIONS:

A. Firm with at least 3 years of successful application, installation, and testing experience on specified systems and equipment. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electric trade staff shall not be used for the installation of the electronic security system and associated hardware. All installers assigned to the installation of this system or any of its

components shall have a minimum of 3 years experience in the installation of the specified equipment.

B. The responsibilities of the contractor shall include but not be limited to the following:
   1. Shop drawings for all electronic security equipment.
   2. Installation of all new electronic security equipment as documented in the drawings and specifications.
   3. Installation of any required software updates or licensing for the existing ACS as part of this expansion.
   4. Alteration of any existing IDS or ACS security equipment required as part of this expansion.
   5. Wire and wiring termination for all electronic security equipment.
   6. Assisting in the testing and check-out of ACS security equipment.
   7. Testing and check out of IDS system.
   8. Training for all electronic security equipment.
   9. Warranty for all electronic security equipment.
   10. As-Built drawings, operations and maintenance for the complete electronic security.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of system equipment. Include drawings that contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include floor plan layouts showing device locations, vertical riser diagrams, equipment rack details, elevation drawings of equipment racks, sizes and type of all cables and conduits.

B. Test Plan: Contractor shall submit a test plan that defines the tests required to ensure that the system meets technical, operational, and performance specifications, 30 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

C. Manufacturer Certification: Submit a letter from the manufacturer's representative stating the proposed systems being submitted for review are in accordance with the recommendations of the manufacturer.

D. It is the responsibility of the contractor to meet with the appropriate Owner’s representative to compare the placement and installation of proper devices with the drawings and specifications. A 100% device by device test will be conducted by the vendor under the supervision of the Architect / Engineer representative. Punch lists will be developed at that time and furnished to the contractor. All punch list items must be corrected and verified prior to acceptance of the system

1.07 CONTRACT DRAWINGS

A. The Contract Drawings indicate the arrangement of the access control system doors and electronic security devices. Coordinate installation of equipment with the structural, mechanical, and electrical equipment and access thereto. Coordinate installation of recessed equipment with concealed ductwork and piping, and wall thickness.

B. All raceways required for the electronic security System are not shown on the Contract Drawings. It shall be the responsibility of the Contractor to provide raceway fit for the application and sized to meet all NEC requirements.

1.08 RECORD DOCUMENTS

A. At the time of final inspection, provide four (4) sets of complete data on the electronic security equipment used in this project. This data shall be in bound, hard copy form and shall include all as-built drawings required for this project. One (1) CD with complete data and drawings must also be provided. This complete data shall include the following.
   1. Warranty statement (include warranty start date, service provider contact phone number and address)
   2. Letters of certification from system manufacturers
   3. Maintenance and operating instructions on all systems
   4. As-built drawings for all systems with color code to show the actual as-built conditions.

B. All record drawings shall include "as built" system interconnection diagrams with major components identified, along with number and type of interconnecting conductors. Drawings must be submitted as full-size, bound sets as well as electronic files on CD.

C. Binders with maintenance and operating instructions on all systems. These binders must incorporate a cover with project name, an index and sections for each major component.

D. Certification from system manufacturers that systems are installed in accordance with manufacturer's recommendations and are functioning correctly at the time of final inspection.

E. Submit four (4) sets of full size (30” x 42”) of as-built drawings to show wiring for all installed equipment and one (1) electronic copy on CD. Electronic drawings must be AutoCAD “DWG” files.

F. As-built drawings must incorporate point-to-point drawings for all systems with color code to show the actual as-built conditions. Copies of the contract document drawings, without modifications showing actual as-built conditions will not be accepted.

G. The final payment will not be approved until all of the aforementioned requirements for Record Documents have been satisfied.

1.09 WARRANTY

A. The Contractor shall warrant the electronic security system for one year from date of Owner’s Acceptance against defects in equipment or workmanship. Failed equipment shall be replaced by the contractor at no cost to the owner. Owner's personnel may perform initial trouble investigation but replacement of failed equipment and escalated problem support will be handled by the contractor.

B. The warranty period shall not start until the Owner has provided a written Letter of Acceptance. It shall be the Contractor’s responsibility to request and obtain the Letter of Acceptance from the Owner.

C. Once the Contractor has obtained a Letter of Acceptance from the Owner, the Contractor must provide a Warranty Letter to the Owner. The Warranty Letter must state the start date of the Warranty, instructions that explain how warranty request are to be made and contact name / phone number for service.

1.10 DESCRIPTION

A. The work included under this section of the specifications consists of the installation of a complete ACS and IDS systems. Provide all labor, equipment, materials, and supervision to install, calibrate, adjust, document, and test the total system as required herein and on the drawings.

B. The contractor shall provide all documentation and shall perform all duties involved in obtaining permits and inspections as required to complete the project. All permitting shall be within the associated city or jurisdiction.

C. The work shall consist of the installation of a complete electronic security system consisting essentially of, but not limited to, the following major components:
   1. Installation of Control Panels, control modules and keypads
   2. Field Peripheral Devices (i.e., duress switches, keypads, door position switches, card readers and door sounder hardware, etc.)
   3. Power supplies, Batteries & Uninterruptible Power Supplies (UPS)
   4. Low Voltage Cable and Raceway
   5. Access control components

PART 2 PRODUCTS

2.01 SYSTEM ARCHITECTURE

A. The access control and alarm monitoring system shall be a flexible single-user, open-architecture facility management system. The system shall be designed using reliable state-of-the-art technology allowing for easy and economical expansion. The scalable design shall allow for operation from an embedded Web based server without a dedicated server or PC workstation. The panel must also have the capability to operate in a hosted mode with WinPak SE/PE access control software.

B. The system shall feature embedded Linux software that intelligently controls the reader network to provide automated data collection and configuration updates, facilitating seamless operation from controllers. All control panels shall utilize off-line distributed processing concepts including inter-controller communication if upgraded.

C. Connecting to the NetAXS web server shall be accomplished via USB, Ethernet through a web server hub connection or Ethernet through web server direct connection.

D. Supported browsers shall include Internet Explorer. The web browser control will allow full control monitor, view live events and manually control doors and readers. Secure web browsing shall be SSL and SHA-1 secure socket layer encryption.

2.02 SYSTEM

A. The software suite shall comprise various integrated software modules that allow for the full integration and retrieval of transactions from the hardware, as well as alarm monitoring, reporting, and scheduling capabilities. The software modules shall allow editing of personnel, access levels, system configuration and reporting to be controlled by a password protected user interface. System operation for individual operators shall be possible using assigned passwords only.

B. The user shall have the ability to perform hardware configuration changes during or after the installation which shall include functions such as door open time, door contact time, location and reader names, and access rights configuration.

C. The system software shall support configuration of alarms triggering the system.

D. The system shall incorporate scheduled events activated by either time or a specific programmed event, therefore being time or event triggered.

E. Access control functions shall include validation based on time of day, day of week, holiday scheduling, and access validation based on positive verification of card or card + PIN (Personal Identification Number).

2.03 DOOR CONTROL PANELS

A. The ACS control panels shall be intelligent and fully stand-alone processor capable, making all local access control and alarm monitoring decisions without host server dependency. Control panels shall support and provide the following:
   1. Types of NetAXS panels available are: NetAXS-4 panel and NetAXS-123 panel.
   2. Panels (NetAXS-123 and NetAXS-4) are called as Gateway panels when added directly to the communication server.
   3. NetAXS-4 Gateway panel supports the downstream devices feature. This feature shall extend the input and output capabilities of the NetAXS-4 panels.
   4. NX4IN and NX4OUT
      a. NX4IN is a 32 input and 0 output downstream add on device
      b. NX4OUT is a 2 input and 16 output downstream add on device
   5. Supports only the WIEGAND card format. The NetAXS panel allows multiple sets of card numbers and site codes embedded in a card format. These multiple embedded sets will be represented as A, B, C, and D sets of card numbers and site codes. The A set shall be used as the default / primary card and site code numbers. The resulting maximum length of the card number will be 64-bits in length (20-digit card number). This is the reason that the system defaults will incorporate the ability to select a 20-digit card number size in addition to the existing 5, 12 and 16 digit
   6. Supports 128 time slots and 256 holidays (per holiday group). Holidays shall be definable in two different holiday types thus allowing for different operational time definitions for each holiday type. The NetAXS panels shall have a provision to add a new time zone while within the panel database. After creating the new time zone, it shall be added to the Time Zones database and applied to the panel's database.
   7. Panel options such as Anti-passback, Groups, Forgiveness, Continuous Card Reads, Reverse Read LEDs, Host Grant, Site Codes, and Command File can be set for providing access to the readers, input points, and output points attached to the NetAXS panels.
   8. NetAXS-4 panel shall allow configuring of 14 inputs with default values. NetAXS-123 panel shall allow configuring 15 inputs with default values.
   9. NetAXS-4 panel shall support 4 readers. NetAXS-123 shall support 6 readers controlling 3 doors where the "A" reader is the primary reader for the door and the "B" reader is the Out reader for the door when so used. The B Reader can be programmed separately regarding name, Advanced Options, Anti-Passback configuration, and Intrusion support. The B Reader cannot work alone as a Reader only. When used, the B reader will be tied to the A reader in terms of the interlock relationships pertaining to Door operation. The Advanced Options selection shall provide several advance features not normally used in the typical system and thus the reason they are accessed separately to reduce confusion for typical installations. For the NetAXS-123, Reader A and Reader B shall support their own settings.
   10. The Groups option shall be supported only by the NetAXS-4 panels. A maximum of 64 groups shall be defined with a maximum of 76 relays.

2.04 CONTROL SYSTEM D.C. POWER SUPPLY

A. All power supplies shall be UL recognized for Access Control and Fire, and shall be equipped with supervised fire alarm disconnect and AC power fail supervision.

B. Provide low voltage power supply units associated with Local Interface Units and Door Control Panels and as required to provide regulated, filtered D.C. power for system control boards, field devices, auxiliary hardware, and signal devices.

C. Output power shall be 12 or 24 volt D.C. with ampere rating not less than 150% of load imposed on power supply under most severe conditions of load. D.C. output shall be fused. Output voltage shall be regulated within plus or minus 5% from no load to full load.

D. Low voltage power supplies shall have built-in charger with automatic switch over to stand-by battery when AC fails. Contractor to provide battery backup for all control system power supplies to allow a minimum run time of 45 minutes.

2.05 ELECTRONIC LOCKING POWER SUPPLY

A. Electronic locking power supplies shall be provided and installed by the Door Hardware Provider and coordinated with the Security Contractor for connection to the ACS system. Coordinate with door hardware provider for locations and cabling requirements.

B. Output power shall be 12 or 24 volt D.C. with ampere rating not less than 150% of load imposed on power supply under most severe conditions of load. D.C. output shall be fused. Output voltage shall be regulated within plus or minus 5% from no load to full load.

C. Low voltage power supplies shall have built-in charger with automatic switch over to stand-by battery when AC fails. Contractor to provide battery backup for all control system power supplies to allow a minimum run time of 45 minutes.

2.06 ELECTRONIC LOCKING HARDWARE

A. Electronic locking hardware shall be provided and installed by the Door Hardware Provider and coordinated with the Security Contractor for connection to the ACS system.

B. Security Contractor shall be responsible for the interface with and connection to any electrified door hardware including door position sensors, request to exit, and door force/prop alarm.

C. Electronic locking hardware shall consist of electro-magnetic locks and/or electric strikes installed according to NEC & IBC requirements as well as the requirements of the local Authority Having Jurisdiction (AHJ) and shall meet the following minimum requirements.
   1. All locking hardware shall meet requirements for emergency path of egress.
   2. Locking hardware shall be supplied power from UL listed dedicated power supplies with battery backup connected to the ACS system and monitored for power loss.
   3. Lock power supplies shall be interfaced with the Fire Alarm System to release power upon fire alarm.

2.07 BULDING HARDWIRED CARD READERS

A. Contractor to provide multi-technology proximity/smart card/NFC technology cards readers that at present shall operate with 125 KHz proximity card technology.
   1. Read range shall not be less than 5.5 inches.
   2. Card readers shall be equipped with multi-color LED’s and internal beeper. Control of the LED’s and beeper shall be internal or from the host.
   3. Card reader must be housed in a weatherproof and secure potted enclosure.
   4. A minimum of two (2) color options must be provided to the Owner.
   5. A low profile version, as well as a surface mounted mid-range device with / without keypad and a surface mounted long range device.

B. All Card Readers shall be HID Multiclass SE Readers.

2.08 PROXIMITY CARDS

A. Contractor to provide new 125kHz proximity cards compatible with the specified Card Readers.

B. Proximity cards shall meet the following minimum requirements:

C. PVC construction or ABS shell with PVC insert.

D. 26 bit Format, ISO 7810 compliant.

E. Sequential, matching external/internal card numbers.

F. Matching facility code.

G. Provide quantity of 100 cards included in base price.

2.09 DOOR POSITION SWITCH CONTACTS

A. Provide magnetic contacts where shown on the contract drawings. All door contacts shall be UL Listed.

B. Surface mounted door contacts shall be provided with total encapsulation to protect against moisture. Door contact shall have anodized aluminum finish, with an armored stainless steel flexible cable and be double pole/double throw. Contractor to furnish and install Interlogix 2500 series or approved equal. One set of contacts shall be reserved for future use.

C. Door contacts for surface mount roll-up door locations shall rated for harsh, commercial environments. Contact must be provided with total encapsulation to protect against moisture. Door contact shall have anodized aluminum finish, with armored, stainless steel flexible cable. Contractor to furnish and install Interlogix 2200 series or approved equal.

D. Double pole/double throw door contacts for recessed mounted swing or sliding door locations shall be Interlogix 1076, 1078, or equal. One set of contacts shall be routed to intrusion detection system with second set of contacts routed to access control system.

E. Door contacts mounted in locations, other than those shown in the Contract Drawing Details (hinged side of door, surface mounted when Details require recessed, etc.), will not be allowed.

2.08 REQUEST TO EXIT DEVICES

A. Provide request to exit (REX) devices where request to exit signal is not available from door hardware.

B. REX device shall be used to shunt DPS alarm, and shall activate an input to the ACS to unlock door hardware. REX devices shall not lock or unlock door hardware directly.

C. REX (PIR) devices shall have wide angle, long range lenses (adjustable) to detect motion of personnel desiring to exit through the door. Coordinate exact field mounting location to provide best operation of (PIR) type (REX) device. (PIR) device shall operate at 9.0 to 16.0 VDC and have form-C output contacts rated at minimum 24 VDC/0.5 amps. Request to Exit sensors shall be Honeywell IS310 or approved equal.

D. Any doors requiring magnetic locking hardware will require REX push-to-exit buttons for door release. Push-to-exit buttons shall be equipped with an integrated 30 second timer and meet the Americans with Disabilities Act (ADA) and all applicable codes.

2.09 EMERGENCY EGRESS DEVICE

A. Emergency egress device shall be required at any door provided with magnetic locking hardware and where electronic locking hardware prevents exiting through a designated emergency path of egress.

B. Emergency egress device shall be a mechanically operated device to provide direct interruption of locking hardware without interface to electronic controllers or relays.

C. Emergency egress devices for this project shall be Panic push bar devices integrated with the electronic hardware, and shall be provided and installed by the door hardware contractor.

D. It shall be the responsibility of the Security Contractor to notify the design team and Owner of any access controlled door that does not meet emergency egress requirements.

2.10 SYSTEM WIRING

A. Cable must meet minimum NEC requirements for Class 2 wiring. Power wiring for door sounders shall not be smaller than No. 18 AWG.

B. All wiring shall be in accordance with the manufacturers written recommendations. All cabling/wiring shall be submitted in a detailed spreadsheet including cut sheets and samples to the Owner prior to any installation.

C. All wiring shall be routed directly to the control panel or device without junctions or splices in cabling.

D. All conductors within junction boxes, pull boxes, and equipment cabinets shall be grouped and laced with nylon tie straps with identification tab, for individual lock sets.

E. All cabling shall be appropriately rated for installation in the space and supported per NEC, IBC, and manufacturers specifications.

F. IP cabling for security:
   1. Description: Category 6, 100-ohm, 4-pair UTP, 350 MHz certified cable, covered with a **Green** thermoplastic jacket or as directed by the Owner Representative.
   2. Comply with ICEA S-90-661 for mechanical properties.
   3. Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.
   4. Comply with ANSI/TIA/EIA-568-B.2, Category 6.
   5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types: Communications, Plenum Rated: Type CMP.
   6. Reference Specifications Section 270100 – Communications General for manufacturer and warranty requirements.

2.11 INTRUSION ALARM CONTROL PANEL

A. The control panel shall be an 8-partition, UL commercial and burglary control panel that supports up to 128 zones using basic hardwired, polling loop, and wireless zones, RF receivers, and relay modules. The control shall provide the ability to schedule time-driven events, and allow certain operations to be automated by pressing a single button. The system shall be capable of interfacing with an ECP long range radio (LRR) unit that can send Contact ID messages. The control shall provide integrated access control and CC database.

B. Intrusion Alarm Control Panel shall be Honeywell Vista 128 series.

2.12 INTRUSION SYSTEM KEYPADS

A. Keypads shall be a 1-line, 16-character English language display for complete zone identification and system status. The keypad shall be wall mounted. Keypads shall be typical to Honeywell 6160 or approved equal.

2.13 360 DEGREE MOTION DETECTORS

A. The security system shall be connected to 360 degree ceiling mounted motion sensors where shown on the drawings.

B. 360 degree motion detectors shall be Honeywell model DT6360STC or approved equal.

2.14 WALL MOUNT MOTION DETECTORS

A. The security system shall be connected to wall mounted motion detectors where shown on the drawings.

B. 180 degree motion detectors shall be Honeywell model DT7450 or approved equal.

2.14. LONG RANGE MOTION DETECTORS

A. The security system shall be connected to wall mounted long range motion detectors.

B. Long range motion detectors shall be Honeywell model DT6100STC or approved equal.

2.15. DURESS STATIONS

A. Duress buttons shall be connected as single and unique alarm points into the card access system. Zoning will not be permitted.

B. Duress buttons shall be mounted beneath the work surface in a coordinate location with the building owner.

C. Duress button shall be Interlogix Panic Switch 3045-W or approved equal.

2.16. DOOR RELEASE BUTTON

A. The door release button shall the following specifications:
   1. Under counter/Desk mount
   2. Momentary (non-latching) pushbutton
   3. SP/DT contact rated at 4Amp

B. Door release button shall be United Security Products HUB2SA, Alarm Control TS-18, or approved equal.

2.17. DOOR SOUNDERS

A. Door Alarm sounders shall be private mode audible signaling device mounted at 80” AFF. Sounders shall be white in color.

B. Device shall have field selectable chime tones and volume control.

C. Door Sounder shall be typical to System Sensor CHW.

2.18. TRANSIENT VOLTAGE SURGE SUPPRESSION

A. Protect all equipment against surges induced on all control and power cables. All copper cables and conductors that serve as 120V power and control conductors shall have surge protection circuits installed at each end and locations where conductors enter or exit a building. Fuses shall not be used for surge protection.

B. Surge suppression devices shall meet the following standards/publications:
   1. UL 497B
   2. UL 1449 (must meet 330 Volt suppression rating)
   3. IEEE Category B impulse and ring wave tests

C. Acceptable Manufacturers: Northern Technologies, Inc., EDCO. Product shall be warranted against defect for a period of not less than five (5) years.

D. All power connections, including 24 VDC and 24 VAC power supplies and direct wired or plug-in 120 VAC power connections, for all systems and components specified herein, shall

be equipped with surge suppression devices. Devices shall be bonded to building grounding system in accordance with Article 250 of the National Electric Code.

E. Grounding: Provide a dedicated, separate No. 6 AWG copper conductor from true earth ground (grounding rod) to all security equipment rooms, security equipment cabinets, and control rooms. Connect all lightning protection devices and security equipment non-current carrying metal parts to grounding conductor in accordance with Article 250 of the National Electric Code. Provide ground bus bar in each equipment room and control room with dedicated ground conductor to each cabinet, enclosure, pull/junction box and all equipment.

F. Ground Resistance Measurement: Each signal ground system D.C. resistance shall be measured between any point on the signal ground bus and the earth ground. An instrument designed specifically to measure the resistance of a point to each earth ground shall be used. The systems subcontractor shall measure ground resistance in accordance with the procedure as outlined by the test equipment manufacturer.

PART 3 EXECUTION

3.01 WIRING SYSTEMS

A. Protect all communication and data equipment against surge induced on all control, sensor and data cables. All cables and conductors which serve as control, sensor, or data conductors shall have surge protection circuits installed at each end that meet the IEEE 472 surge withstand capability test and the electrical transient tests established in UL365. Fuses shall not be used for surge protection.

B. All cables and conductors which serve to distribute power to devices shall be a minimum 18 AWG and shall be readily identifiable by jacket color and/or shall be provided with permanently affixed labeling within 3” of each termination.

C. Wiring connectors shall be manufactured and rated for use with the cable type and applications. All cabling connections, junctions, splices, etc. shall be provided with wiring connectors suited for the application.

D. Access control system cabling shall not be permitted to be exposed and shall be recessed in wall, or provided in conduit stub-up above accessible ceiling. Surface mount raceways shall be hardened against cutting or breaking and shall be mechanically fastened to the building structure.

E. Exterior conduits routed underground shall be provided with galvanized rigid metal conduit sleeves or elbows where turned up from grade or shall be otherwise protected by a suitable enclosure or pedestal.

F. Devices installed in ceiling tiles shall be provided with backbox and grid span bar with additional cable support from structure.

G. Where applicable, Electrical and Low voltage cables located in shared backbox or cabinet shall be provided with mechanical separation to prevent EMF interference meeting NEC and manufacturer requirements.

3.02 SYSTEM SET-UP

A. Contractor shall be responsible for fully customizing system(s) to meet the requirements of the building operators. After all devices have been properly terminated and tested, contractor shall system configuration meetings and shall be responsible for fully customizing system.

B. Access Control System setup shall include coordination with Intrusion Detection, Fire Alarm System, Intercom System, and Video Surveillance system installation to provide applicable

programming for outputs and inputs to connected system. Programming to include, but shall not be limited to, the following:

1. Lock Power supply connection to Fire Alarm System for deactivation upon alarm.
2. Remote lock/unlock operation by Intercom System
3. Alarm detection triggering to Intrusion Detection system.
4. Event triggered output to Video Surveillance system.

3.03 TESTING

A. Testing requirements apply to all new construction.

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

C. 100% system function test shall be required prior to final approval. Security Contractor to schedule system function test with design team and Owner 10 business days in advance and shall provide a minimum of two representatives knowledgeable of the facility and installed systems with the ability to escort design team to all device and panel locations. System test shall require one representative to accompany design team for field testing devices, and one representative to provide reporting and verification of signals from the ACM. System test shall include, but not be limited to the following items:

1. Card Reader operation for valid & invalid card read.
2. Lock hardware operation.
3. DPS function, Door force alarm, and door prop alarm.
4. Request to exit functions.
5. Emergency egress functions.
6. Lock power supply functions including release upon Fire Alarm activation.

3.04 TRAINING

A. The Contractor shall include in the base Contract all costs required to train Owner designated operating and maintenance personnel in the use and maintenance of systems provided under this section of the Specifications. Training sessions shall be conducted by instructors certified in writing by the manufacturer of the specific system.

B. Sessions shall be conducted for not more than four hour periods during normal working hours, i.e., Monday through Friday, 8:00 AM to 5:00 PM. Training session schedules shall conform to the requirements of the Owner; therefore such schedules shall be submitted to the Owner for approval not less than two weeks prior to the training session. All training sessions shall be video-taped and saved to digital disk as well as the server hard drive for future reference.

C. Time to be included in base Contracts for the Access Control System shall be 8 hours.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish, install, connect and test a microprocessor controlled, addressable fire detection and alarm system.

B. The system shall include the following components to form a complete, coordinated and operational system:
   1. Fire Alarm Control Panel (FACP)
   2. Fire Emergency Voice/ALarm Communication System (EVACS)
   3. Alarm Initiating Devices
   4. Alarm Notification Appliances
   5. Auxiliary Control Devices
   6. Annunciators
   7. Power Supplies
   8. Wiring and Conduit
   9. Digital ALarm Communicator (DACT)

C. Duct mounted smoke detectors are scheduled for mounting by Mechanical Division. Furnish and connect detectors under this section of work. Provide manufacturer's published mounting instructions to Mechanical Contractor.

D. Fire protection water valve supervisory devices are scheduled to be furnished and installed under Mechanical Division. Connect to all devices required for supervisory monitoring by the fire alarm system.

1.02 SOURCE

A. All of the products described by this section shall be supplied by the manufacturer of the Fire Alarm System or their local area factory authorized vendor.

B. All components shall be shown on detailed system design drawings, which shall be prepared by the manufacturer of the authorized vendor.

C. The equipment and devices indicated on the drawings are the minimum required to be furnished. System designer shall verify and comply with other requirements prescribed by the Owner or their authorized representative and include in the final shop drawing design.

1.03 STANDARDS

A. All components of the system shall be listed by Underwriters Laboratories, Inc., and be factory mutual (FM Global) approved.

B. The installed system shall comply with the requirements of NFPA 72 for Protected Premises Fire Alarm Systems, latest edition being enforced by the Authority Having Jurisdiction (AHJ).

C. The installed system shall comply with the latest requirements of the American with Disabilities Act (ADA).

D. The Fire Alarm System installation shall comply with all applicable codes, rules, and regulations as listed in Section 26 05 00.

E. The system shall comply with the requirements of NFPA 13 for monitoring the status of the Fire Protection Water Pre-Action Sprinkler System.

1.04 DESCRIPTION

A. Where a component is described in Part 2 by a manufacturers catalog number, or model series number, the component shall be furnished, as a minimum, complete with all standard features shown on the manufacturers data sheet for that product.

1.05 SYSTEM OPERATION

A. Provide modifications and extensions to the existing fire detection and alarm system with all components necessary for a complete, operational system.

B. Provide emergency Voice Notification.

C. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:

1. Georgia Accessibility Code
2. The Americans With Disabilities Act (ADA).
3. The requirements of the State Fire Marshall.
4. The requirements of the local authority having jurisdiction .
5. NFPA 101.
6. NFPA 72.
7. Factory Mutual.

D. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted units are acceptable.

E. Fire Alarm Control Panels, Initiating Devices, and Notification Appliances:

1. Analog, Addressable type.
2. Listed by Underwriters Laboratories and Factory Mutual as suitable for the purpose intended.
3. Products of a single manufacturer or division thereof.

F. Furnish duct mounted smoke detectors scheduled to be mounted by HVAC Division. Provide manufacturers published mounting instructions to HVAC Division and connect to fire alarm system.

G. Interface fire detection and alarm system with:

1. Fire suppression post indicator valve supervisory devices.
2. Fire suppression flow and tamper switches.
3. HVAC equipment required to be monitored and/or shut down.

1.06 TYPICAL OPERATION

A. Actuation of any manual station, smoke detector, heat detector, fire protection water supervisory device switch, shall cause the following operations to occur:

1. Actuate programmed notification appliances until the panel is reset and enabled.
2. Release programmed magnetic door holders where applicable.
3. Enable programmed outputs for elevator control interface.
4. Activation of any fire protection water supervisory valve tamper switch or flow switch shall cause a system supervisory alarm indication.
5. Activate output contacts interfacing with HVAC equipment, Building Automation System and Security System as programmed.

B. Control of HVAC equipment:

1. Each air handling unit shall be shut down upon alarm signal from its associated duct mount smoke detectors, except as otherwise noted.
2. Addressable I/O modules with contacts shall be provided to be used for required control interface functions.

1.07 SUBMITTAL DOCUMENTS

A. Submittals for Review:

1. Shop Drawings:

a. Scaled floor plan drawings with location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
b. Wiring diagrams indicating internal wiring for each item of equipment and the interconnections between the system components.
c. Notification appliance circuit voltage drop calculations.
d. List of all devices on each signaling line circuit, with spare capacity indicated.
e. Detailed drawing of graphic annunciator(s).
f. Battery calculations.

2. Product Data:
   a. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.

B. Submittals for Project Closeout:
1. Contact information for firm that will be providing warranty service.
2. Copies of final shop drawings and product data.
3. Manufacturer's warranty.
4. Operating instructions including complete programming procedures.
5. Manufacturer's recommended maintenance procedures.
6. Inspection and test reports.
7. CD including electronic version of:
   a. Shop drawings in AutoCAD dwg format.
   b. Shop drawings in Adobe pdf format.
   c. Manufacturer's Operating and Maintenance Manuals in pdf format.

1.08 ABBREVIATIONS

A. “FACP” = Fire Alarm Control Panel
B. “AHJ” = Code Enforcement Authority Having Jurisdiction
C. “FM/AS” = Facility Management/ Alarm System

1.09 INTERFACE WITH OTHER TRADES

A. Provide “Alarm” and “Trouble” Form “C” output contacts for use by the Owner, extended to the building automation system.
B. Field coordinate interface and connection of wiring of devices scheduled for monitoring by the Fire Alarm System which are furnished and mounted by other divisions of work.

1.10 TRAINING

A. System vendor shall provide minimum (8) eight hours of on-site training of Owners personnel in operation, programming, and maintenance of the Fire Alarm Control Panel and all system devices.
B. Training shall be conducted at the convenience of the Owner after the system has been accepted by the Owner as complete.
C. Provide instruction as required for operating the system. “Hands-on” demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
D. The contractor and/or the Systems Manufacturer's representative shall provide a typewritten “Sequence of Operation” to the Owner.

1.11 AS-BUILT DRAWINGS

A. Include location and routing of raceways and devices.

1.12 METHOD OF PROCEDURE (MOP):

A. The system installation shall be in accordance with the approved MOP, manufacturer installation standards, shop drawings, and calculation. Any violation of this will result in an

unacceptable product, and it will be the responsibility of the contractor to dismantle and reinstall the system at no additional cost or scheduling delay to the Owner.

1.13 MAINTENANCE SERVICE CONTRACT

A. Provide maintenance of fire alarm systems and equipment for a period of 12 months commencing with Substantial Completion, using factory-authorized service representatives.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Edwards Systems Technology (EST); iO1000 series panel

2.02 GENERAL

A. All equipment components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a Protected Premises Protective Signaling (fire alarm) System. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. All equipment and components shall be installed in compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the Vendor furnished Riser/Connection diagram for all specific system installation/termination/wiring data details.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (I.e., detectors shall not be supported solely by suspended ceiling tiles.) Fasteners and supports shall be adequate to support the required load.

2.03 CONDUIT AND WIRE

A. Conduit

1. All fire alarm system wiring shall be installed in EMT conduit. Conduit fill shall not exceed 40 percent of interior cross sectional area. Provide pre-printed red color band-type markers around fire alarm conduits at 10' intervals maximum spacing.
2. Paint all fire alarm system J-boxes and covers “red” color.
3. Flexible metallic conduit in lengths not exceeding 3'-0” may be used for connection of duct-mounted detector assemblies.
4. Wall-mounted devices shall be attached to a flush device outlet box with EMT conduit run up to the ceiling and turned out to horizontal orientation and terminated with a suitable conduit bushing installed to protect the cable.
5. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
6. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.

B. Cabling

1. All Fire Alarm System cabling shall be new.
2. Wiring shall be in accordance with local, state and national codes (i.e., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer. All wire shall be minimum #14 AWG THHN/THWN.
3. All conductors #10 AWG and smaller shall be solid.
4. Wiring shall not be spliced. Transposing or changing of wire color shall not be permitted.

5. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
6. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit.
7. All field wiring shall be completely supervised.

C. Terminal Boxes, Junction Boxes, and Cabinets
1. All boxes and cabinets shall be UL listed for their intended purpose.
2. Riser terminal cabinets where required or otherwise installed, shall be of NEMA 12 construction with hinged lockable door with all conductors entering or leaving the cabinet terminated or barrier type terminal blocks. Provide “Stackon” type connectors unless box type terminals with pressure plate are used. Each conductor and terminal shall be permanently numbered. Cabinet shall be permanently identified with engraved nameplate.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

2.04 FIRE ALARM CONTROL PANEL

A. The main FACP shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system:
1. intelligent detectors
2. addressable modules
3. transponders
4. local and remote operator terminals
5. printers
6. annunciators
7. other system controlled devices

B. The main FACP shall perform the following functions:
1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble, and alarm conditions.
2. Supervise all initiating, signaling, and notification circuits throughout the facility.
3. Detect the activation of any initiating device and the location of the alarm condition.
4. Operate all notification appliances and auxiliary devices as programmed.
5. Visually and audibly annunciate any trouble, supervisory or alarm, condition on operator's terminal, panel display, and annunciators.

C. System Capacity and General Operation
1. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, an alpha-numeric keypad for Field Programming and Control of the Fire Alarm System.
2. All programming or editing of the previously installed program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.

D. The main FACP shall be designed so as to permit continued local operation of remote transponders under both normal and abnormal network communication loop conditions. This shall be obtained by having transponders operate as local control panels upon loss of network communication.

2.05 CENTRAL PROCESSING UNIT

A. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the System display by the Central Processing Unit.

B. The Central Processing Unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

C. The central processing Unit shall also provide a real-time clock for time annotation of all system displays. The Time-of-Day and date shall not be lost if system primary and secondary power supplies fail.

D. The CPU and transponders shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems which require use of external programmers or change of EPROMs are not acceptable.

E. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients including RFI and Emi.

F. Each transponder and peripheral device connected to the CPU shall be continuously scanned for proper installation. Data transmissions between the CPU, transponders, and peripheral devices shall be reliable and error free. The transmission scheme used should employ dual transmission or other equivalent error checking techniques. Failure of any transponder or peripheral device to respond to an interrogation shall be annunciated as a trouble condition.

2.06 DISPLAY

A. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

B. The Display Assembly shall contain, and display as required, custom alphanumeric labels for all Intelligent Detectors, Addressable Modules, and software zones.

C. The System Display shall provide an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), which will indicate the status of the following system parameters:

1. AC Power
2. System Alarm
3. System trouble
4. Display Trouble
5. Signal Silence

D. The System Display shall provide a touch keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels will be accessible through the Display Interface Assembly to prevent unauthorized System control or programming.

E. The System display shall include the following operator control switches:

1. Signal Silence
2. Lamp test
3. reset
4. System Test
5. Acknowledge

2.07 LOOP INTERFACE BOARD

A. Loop Interface Boards shall be provided to monitor and control each of the Signaling Line Circuit (SLC) Loops in the system. The Loop Interface Board shall contain its own microprocessor, and shall be capable of operating in Local Mode in case of a failure in the Main CPU of the Control

Panel. In Local Mode, the Loop Interface Board shall detect alarms and activate output devices on its own SLC loop.

B. The Loop Interface Board shall not require any jumper cuts or address switch settings to initialize SLC Loop operations.

C. The Loop Interface Board shall provide power to, and communicate with, all of the Intelligent/Addressable Detectors and Addressable Modules connected to its SLC Loop over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.

D. The Loop Interface Board shall be able to drive two Style 4 runs of these SLC Loops, each up to 10,000 feet in length, for an effective Loop span of 20,000 feet.

E. The Loop Interface Board shall continuously monitor analog information from all intelligent Detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The Loop Interface Board software shall include software to automatically adjust and compensate for dust accumulation to maintain detector performance as it is affected by environmental factors. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

F. The Loop Interface Board shall communicate with each Intelligent/Addressable Detector and Addressable Module on its SLC loop and verify proper device function and status. Communication with up to 198 intelligent devices shall be performed every 6 seconds or less. Average time to detect an alarm shall be 3 seconds (longer for detectors utilizing alarm, verification).

G. Each remote transponder module shall communicate with the fire alarm control panel over a separate SLC loop.

H. Provide (1) one spare board.

2.08 SERIAL INTERFACE BOARD

A. The Serial Interface Board shall provide the EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) Peripherals.

B. The Serial Interface Board shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.

C. The Serial Interface Board shall provide EIA-485 port for the serial connection of the Annunciators and Control Subsystem components.

D. The Serial Interface Board shall have LEDs which will show that it is in regular communication with the Annunciators or other EIA-485 connected peripheral device.

E. All EIA-232 circuits shall be optically isolated and power limited.

2.09 ENCLOSURES

A. The control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

B. The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top.

C. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left-hand side.

D. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

2.10 POWER SUPPLIES

A. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

B. It shall provide notification appliance power as required for the devices shown on the drawings using a switching 24 VDC regulator.

C. It shall be expandable for additional notification appliance power in minimum 3.0-ampere steps.

D. It shall provide a battery charger for 24 hours of standby, using dual-rate-charging techniques for fast battery recharge.

E. It shall provide a very low-frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.

F. It shall be power-limited using Positive Temperature Coefficient (PTC) resistors.

G. It shall provide meters to indicate battery voltage and charging current.

2.11 SYSTEM CIRCUIT SUPERVISION

A. The FACP shall supervise all circuits to intelligent devices, transponders, annunciators, and peripheral equipment and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information on the printer.

B. Transponders that lose communication with the CPU shall sound an audible trouble and light LED-indicating loss of communications.

C. Transponder Circuit Television: The transponders shall be designed such that they continuously scan all of their initiating and indicating circuits. With normal communications between the FACP and the transponders, the transponders shall transmit initiating and indicating circuit trouble conditions to the FCAP for audible annunciation and printout. With or without communication with the FACP, the transponders shall supervise their circuits and annunciate any initiating circuit and indicating circuit failures on LEDs located on the transponder.

D. Fire protection water standpipe control valves, and main gate valves shall be individually supervised to indicate off-normal position.

E. Fire protection water flow switches shall be individually supervised to indicate off-normal position.

F. Air sampling system output contacts shall be individually monitored.

2.12 FIELD WIRING TERMINAL BLOCKS

A. All component assemblies wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Fixed terminal blocks are not acceptable.

2.13 OPERATOR'S TERMINAL

A. Acknowledge (ACK/STEP) Switch:

1. Activation of the control panel Acknowledge switch in response new Alarm and/or Trouble condition shall silence the local panel piezo electric signal and change the System Alarm or Trouble LED from flashing mode to steady-ON mode. If additional new Alarm or Trouble conditions exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next Alarm or Trouble condition.

2. Depressing the acknowledge switch shall also silence all remote annunciator piezo sounders.

B. Signal Silence Switch

1. Activation of the Signal Silence Switch shall cause all programmed Alarm Audible Notification Appliances and relays to return to the normal condition after an alarm activation. The selection of notification circuits and relays which are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.

C. System Reset Switch

1. Activation of the System Reset Switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as associated output devices and circuits, to return to their normal condition.
2. If the alarm condition (s) still exist, or if they reoccur in the system after System Reset Switch activation, the system shall then resound the alarm conditions.

D. System Test Switch

1. Activation of the System Test Switch shall initiate an automatic test of all intelligent/Addressable detectors in the system. The System Test shall activate the electronics in each intelligent sensor, simulating an alarm condition and causing the transmission of the alarm condition from that sensor to the Fire Alarm Control Panel. The Fire Alarm Control Panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the System Liquid Crystal Display, as well as on any CRTs or printers in the System.

E. Lamp Test Switch

1. Activation of the Lamp Test Switch shall sequentially turn on all LED indicators, System Liquid Crystal Display and Local Piezo-Electric signal, and then automatically return the Fire Alarm Control Panel to the previous condition.

2.14 FIELD PROGRAMMING

A. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.

B. All programming shall be accomplished through the standard FACP keyboard through the video display terminal.

C. All field-defined programs shall be stored in non-volatile memory.

D. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Minimum of two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.

E. The system shall be capable of programming any addressable input or initiating device to operate any single or group of addressable output devices or indicating circuits. Inputs shall be programmable to generate alarm or trouble or no audible alarm.

2.15 SPECIFIC SYSTEM OPERATIONS

A. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity or any or all analog intelligent smoke detectors in the system from the System keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.

B. Alarm Verification: Each of the Intelligent/Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

C. System Point Operations

1. Any Device in the system may be enabled or Disabled through the system keypad or video terminal.
2. Any system output point may be turned on, or off, from the system keypad or the video terminal.

D. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point will be annunciated for the parameters listed:

1. Device status

2. Device type
3. Custom device label
4. Software zone label
5. Device zone assignments
6. Detector analog value
7. All program parameters

E. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all system status.

F. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that shall be capable of storing up to 400 system output/input/control activations. Each of these activations will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The content of the History Buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed or printed.

G. The History Buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.

H. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each Intelligent System Detector and shall analyze the detector responses over a period of time.

I. If any Intelligent Detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular Intelligent Detector will be annunciated on the System Display, and printed on the System printer. This feature shall in no way inhibit the receipt of Alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

2.16 VOICE EVACUATION PANEL

A. Microprocessor-based Central Processing Unit (CPU). The CPU shall distribute and control emergency voice messages over the speaker circuits.

B. Integral 50 Watt, 25 Vrms audio amplifier.

C. 8 zone speaker circuit that can be wired both Class A or B.

D. Digital Message Generator with a memory capacity for up to 60 seconds of messaging. Capable of producing five distinct messages (12 seconds each). These messages shall field programmable without the use of additional equipment.

E. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.

F. Capable of detecting and annunciating the following conditions:

1. Loss of Power (AC and DC)
2. System Trouble
3. Ground Fault
4. Alarm
5. Microphone Trouble
6. Message Generator Trouble
7. Tone Generator Trouble
8. Amplifier Fault

G. Fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generation.

H. Speaker outputs shall be power-limited.

I. Amplifiers powered independently to prevent a short on one circuit from affecting other circuits.

2.17 SYSTEM COMPONENTS

A. General Requirements
   1. Housing color - white or red as selected by the Architect.
   2. Suitable for mounting on a flush mounted box.
   3. Where surface mounted backbox is utilitized, provide accessory backbox skirt.

B. Power Supplies
   1. Where new additional power supply equipment is required for serving new devices, the power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power as required for the devices shown on the Drawings using a switching 24 VDC regulator..
   2. It shall be expandable for additional notification appliance power in minimum 3.0-ampere steps.
   3. It shall provide a battery charger for 24 hours of standby, using dual-rate-charging techniques for fast battery recharge.
   4. It shall provide a very low-frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.
   5. It shall be power-limited using Positive Temperature Coefficient (PTC) resistors.
   6. It shall provide meters to indicate battery voltage and charging current.

C. Strobe Lights
   1. Shall operate on 24 VDC nominal.
   2. Xenon strobe type.
   3. 75 candela intensity, unless noted otherwise.
   4. Shall meet the requirements of the ADA as defined in UL standard 1971 and the following criteria:
      a. The maximum pulse duration shall be 2/10ths of one second.
      b. Unless otherwise specified on the drawings, the intensity shall be a minimum of 75 candela.
      c. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
      d. The bottom of the appliance shall be placed 80 inches (2,030 mm) above the highest floor level within the space, or the top of appliance 6 inches (152 mm) below the ceiling, whichever is the lower.
   5. Visual-only devices shall have flush cover plate where installed flush.

D. Audible Notification Appliances
   1. Speaker
      a. Field selectable output taps from 0.25 to 2.0 Watts.
      b. Maximum sound output of 84 dBA at 10 feet.
      c. Frequency range - 400 Hz to 4000 Hz.
      d. Sealed to protect the speaker cone from damage and dust.
   2. Shall meet the applicable requirements for audibility.
   3. Shall be mounted at 96” A.F.F.
   4. With flush cover plate where installed flush.

E. Audible/Visible Combination Appliance
   1. Same requirements as above, factory-combined single assembly.
   2. Visible appliance powered independent from audible.

F. Addressable Manual Stations
   1. Addressable Manual Stations shall be provided to connect to the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops. Up to 99 addressable manual stations may be connected to one SLC loop.

2. The manual Station shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. Manual Fire Alarm Stations shall use a key operated test-reset lock, and shall be designed so that after actual Emergency Operation, they cannot be restored to normal use except by the use of a key.
3. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key.
4. Manual Stations shall be double action, constructed of high impact LEXAN with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.
5. Stations shall be suitable for surface or semiflush mounting, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.
6. The Manual Station shall provide address-settings means using rotary decimal switches.
7. Provide manual fire alarm box cover, STI "Stopper II" for each manual station. Cover shall be tamper-proof, clear Lexan plycarbonate shiled and frame suitable for mounting over flush-mounted or surface-mounted manual stations. The cover shall contain an integral horn that will sound an 85db warning tone with the cover is lifted. The power source shall be a 9-volt dc alkaline battery included with the unit.

G. Intelligent Photoelectric Smoke Detectors
1. Smoke detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuit loops. Up to 99 intelligent detectors may connect to one SLC loop. Provide photoelectric detectors only, except where indicated otherwise on the drawings or specification.
2. The detectors shall use photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
3. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel.
4. The detectors shall provide address-setting means on the detector head using decimal switches. The detectors shall also store an internal identifying code which the control panel shall use to identify the type of detector.
5. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating the detector is operational and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be controlled through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
6. Provide remote detector lamps and remote test/reset function capability where new duct-mounted detectors are installed and not readily accessible for test/reset and maintenance purposes.

H. Intelligent In-duct Smoke Detector and Housing
1. In-Duct Smoke Detector Housing shall include an intelligent Photoelectric Detector which provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the distribution of toxic smoke and fire gasses throughout the areas served by the duct system.
3. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions. In certain applications, LEDs may be selected to be polled without

flashing through the system programming. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

4. An output connection shall also be provided in the base to connect an external alarm LED.

I. Intelligent Heat Detectors

1. Heat Detectors shall be Intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits. Up to 99 intelligent heat detectors may connect to one SLC loop.
2. The detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.
3. The detectors shall be ceiling-mount and shall include a twist-lock base.
4. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or initiated on command from the control panel.
5. The detectors shall provide address-setting means on the detector base using decimal switches.
6. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions. In certain applications, LEDs may be selected to be polled without flashing through the system programming. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
7. An output connection shall also be provided in the base to connect an external alarm LED.

J. Monitor Module - (ADDRESSABLE INPUT DEVICE)

1. Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.
2. The Monitor Module shall mount in a 4-inch square, 2-1/8” deep electrical box.
3. The IDC zone may be wired for Style D or Style B operation. The Monitor module shall provide address-setting means using decimal switches and shall also store an internal identifying code, which the Fire Alarm Control Panel shall use to identify the type of device.
4. An LED shall be provided which shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

K. Control Module (ADDRESSABLE OUTPUT DEVICE)

1. Addressable Control Modules shall be provided to supervise and control the operation of conventional Indicating Appliance Circuit (IAC), speaker circuit, or telephone circuit. For auxiliary control functions, the control module may be set to operate as a dry contact relay.
2. The Control Module shall mount in a standard 4-inch square, 2-1/8” deep electrical box, or to a surface mounted backbox, or directly in the Fire Alarm Control Panel.
3. The IAC may be wired for Style Z or Style T IAC (Up to 48 Watts of Audio Speaker power) or as a Dry Contact (Form C) Relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure 100% of all auxiliary relays or IACs may be energized at the same time on the same pair of wires.
4. Audio/Visual power shall be provided by a separate supervised Power loop from the main Fire Alarm Control Panel or from a supervised, UL listed Remote Power Supply.
5. The Control Module shall provide address-setting means using decimal switches and shall also store an internal identifying code, which the Control Panel shall use to identify the type of device. An LED shall be provided which shall flash under normal conditions, indicating that the Control Module is operational and is in regular communication with the Control Panel.

6. A magnetic test switch shall be provided to test the module without opening or shorting its IAC wiring.

L. Isolator Module
1. Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section of the SLC loop.
3. The Isolator Module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its operation.
4. The Isolator Module shall mount in a standard 4-inch deep electrical box, or in a surface mounted backbox. Locate module in a conspicuous place and provide nameplate on cover of device.
5. It shall provide a single LED, which shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

M. Battery System
1. Capacity to power system for minimum 24-hours plus 5-minutes of alarm upon AC power failure.
2. Maintenance free.
3. Date stamp indicating month and year of manufacture.
4. Shall be 12 volt, Gel-Cell type.
5. Battery shall have sufficient capacity to power the fire alarm system for time period in accordance with applicable codes, minimum 24 hours.
6. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks, refilling, spills and leakage detection shall not be required.

2.18 REMOTE DISPLAY ANNUNCIATOR

A. Features
1. 80-character Liquid Crystal Display
2. Control switches for Acknowledge, Silence and Reset.
3. Time and Date field
4. Local piezo sounder with resounder feature
5. Mimic main FACP display panel
6. Integral Microphone

B. Mounting
1. Flush mounting.

C. Input Power
1. Provide power from main FACP.

2.19 REMOTE COMMUNICATOR

A. Provide a dual line fire alarm communicator module within the system control panel. Panel shall contain supervised disconnect switch to allow testing of system without notifying fire department.

B. Shall contain "dialer-runaway" feature preventing unnecessary transmissions as a result of intermittent faults in system.

C. Shall be Carrier Access Code (CAC) compliant.

D. A system employing a DACT shall employ one telephone line (number). In addition, one of the following transmisison means shall be employed (NFPA 72Chapter 26):

1. One-way private radio alarm system.
2. Two-way RF multiplex system
3. Transmission means complying with NFPA Chapter 26, paragraph 26.6.3.1

PART 3 - EXECUTION

3.01 MATERIAL REQUIRED

A. Conductors required: The quantity of conductors shown in fire alarm conduits on the drawing is not intended to meet the needs of all system manufacturers. Provide conductors as required for the system being furnished, and in accordance with the system drawings prepared by the system manufacturer.

B. The fire alarm plan as shown on the drawings is intended to illustrate the general system configuration as designed and may not reflect the actual quantity of initiating devices, indicating devices, addressable output devices, and addressable input devices required. Provide such devices as are shown on the drawing floor plans and as required to provide system functions as described herein.

C. All fire alarm conductors shall be installed in EMT conduit or other raceways as building construction may dictate.

3.02 INSTALLATION

A. Installation shall be in accordance with all indicated standards, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted insofar as possible when located in finished areas and may be surface mounted when located in unfinished areas.

D. All surface mounted devices shall be installed using the manufacturers standard surface mount box or other suitable finish enclosure.

E. Coordinate exact location of ceiling mounted detectors to avoid direct discharge from air conditioning system supply air diffusers. Maintain minimum 4'-0” separation.

F. Detector sensitivity shall be set as recommended by the equipment manufacturer for the airflow to be encountered.

G. Duct-mounted detectors shall be furnished under this Division and mounted under the Mechancial HVAC Division of Work. Field coordinate the installation work with the mechanical sub-contractor.

H. Detectors shall not be installed in a sub-base until after the construction clean up of all trades is complete and final. Detectors installed prior to final clean up by all trades shall be replaced and the system re-certified.

I. Smoke dampers, furnished and installed under Mechanical Division, shall be controlled by the associated duct-mounted smoke detector and by the mechanical room area detectors where dampers are not within an enclosed plenum.

J. Paint all exposed raceways to match adjacent surfaces. Paint all fire alarm system junction boxes and covers red color.

K. Install conduit band markers at required locations based on raceway layout.

L. Provide engraved nameplates for FACP, Remote Annunciators and modules. Identification nameplates shall be red with white letters.

3.03 TEST

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and installation.
   2. Open initiating device circuits and verify that the trouble signal actuates.
   3. Open signaling line circuits and verify that the trouble signal actuates.
   4. Open and short notification appliance circuits and verify that the trouble signal actuates.
   5. Ground initiating device circuits and verify response of trouble signals.
   6. Ground signaling line circuits and verify response of trouble signals.
   7. Ground notification appliance circuits and verify response of trouble signals.
   8. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
   9. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
   10. Verify proper operation of program log in including control of HVAC devices and elevator interface.

3.04 OPERATIONAL REVIEW AND CERTIFICATIONS

A. In the presence of the Owner's designated representative, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

B. Certificate of Completion: Provide a NFPA “Certificate of Completion and Certification” documents for the completed Fire Alarm System indicating compliance with applicable requirements.

3.05 SYSTEM PROGRAMMING

A. Vendor shall provide all labor and materials required for initial programming of Fire Alarm System as directed by the Owner and as specified herein. Request programming requirements from the Owner and as specified herein. Request programming requirements from the Owner sufficiently early in the construction schedule to allow programming of Owners requirements at initial system startup. Initial programming shall include alphanumeric descriptor for each input and output point and logic to perform elevator interface and smoke purge operation.

B. Provide dry contact alarm points for:
   1. Detector activation
   2. Fire detection system trouble
   3. Fire detection system off normal

3.06 DEVICE LOCATION DRAWINGS

A. Provide a professionally prepared scaled drawing of each floor plan indicating the location of each device. All major architectural features shall be shown. The unique address of each device shall be clearly indicated beside the symbol for that device to assist in locating any device in alarm.

B. Each floor plan shall be laminated, framed and mounted in a flip chart arrangement. The flip chart shall be permanently mounted on the wall adjacent to the main Fire Alarm Control Panel in the control room on the first floor and at two additional locations to be determined.

C. Provide an additional device location chart at each non-graphic remote annunciator location indicating the associated floor plan. The device location chart shall be permanently framed and

mounted and installed on the wall adjacent to each annunciator. Each drawing shall contain the information for each floor as described above.

D. Each floor plan shall be a 1/8”=1'-0” scale drawing or a 1/8”=1'-0” scale drawing reduced 50 percent where reduction will not prohibit/inhibit presentation. All lettering shall be clearly legible. Submit a sample for review.

END OF SECTION

SECTION 31 00 01

SITE PREPARATION AND GENERAL SITE WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
1. Site work layout and construction survey.
2. Protecting existing vegetation to remain.
3. Protecting existing site improvements to remain.
4. Utility locates.
5. Disposition of utilities.
6. Maintain existing utility services.
7. Spill prevention.
8. Recycling and waste management for site materials.
9. Final Cleanup

B. Related Sections:
1. 31 00 02 “SITE DEMOLITION” for removal of site improvements including utilities.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Manual for Erosion and Sediment Control in Georgia, 2016 Edition, by the Georgia Soil and Water Conservation Commission, “Best Management Practices”. Apply to all land disturbing activities for all phases of Work.

B. American Society of Civil Engineers (ASCE)
1. ASCE CI 38-2: Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.

1.03 SUBMITTALS

A. Record Drawings: Record active, inactive, relocated, and abandoned utilities encountered.
1. Survey the horizontal and vertical positions, and depths to ground surface, for utilities capped, utilities uncovered during project operations and for utilities relocated. Survey shall be from established project control.

1.04 QUALITY ASSURANCE

Qualifications: The person in responsible charge of construction survey and survey of asbuilt/record drawing items shall be a Professional Land Surveyor licensed in the state of Georgia.

1.05 SITE CONDITIONS

A. Subsurface Conditions: Copies of the following subsurface investigation report(s) of the site are provided for information only:
1. <***Report Title***>”, <*** Report Date ***>, prepared by <*** Name ***>.
<Copies of the subsurface investigation report(s) are available by contacting ****insert name and contact info ****.>
2. Report data is not intended as a representation or warranty of conditions or continuity of conditions. Owner is not responsible for interpretation or conclusions drawn by the Contractor. The data is made available for convenience and is not guaranteed to represent conditions that may be encountered.
3. Contractor shall examine the site and may make its own explorations at its own expense. Notify Owner prior to making any subsurface explorations.

B. Safety: Provide all safety fence barricades guards, lights and other installations required to protect persons and property during the work. This is in addition to such protection required elsewhere in the Contract documents. At a minimum, secure all work areas and staging/storage areas with temporary construction safety fencing. Maintain such safety fencing to assure a complete boundary throughout construction.

C. Locate storage sheds, temporary office, and stockpiled material to best advance the progress of work, as approved by the Design Professional or in areas otherwise designated for Contractor's use.

D. Existing conditions are shown on the drawings. Contractor shall visit the site, familiarize himself/herself with existing conditions in the field.

E. Contractor shall strictly adhere to the "Land Disturbance Construction Activity Sequence" As defined in the Phase I Erosion and Sedimentation Control Plan only upon completion of applicable items in the sequence, shall the contractor expand clearing and grubbing operations to the entire site.

F. Items of historic or archaeological value discovered during construction operations shall remain the property of the Owner. Notify Design Professional immediately of any such type finding for instructions.

1.06 RECYCLING AND REFUSE COLLECTION CENTERS (WASTE MATERIALS)

A. The contractor shall provide appropriate refuse collection centers, which allow for glass, paper, and plastic separation. Said refuse collection centers shall be maintained on a weekly basis and transferred to an Owner-approved recycling and refuse center. The contractor shall also provide appropriate refuse containers for construction debris. Construction debris shall be recycled as possible and practical, especially in demolition and renovation situations (i.e., copper pipe, steel, concrete, glass, etc.). Illegal disposal of said materials (including littering) is subject to fines and penalties. The Contractor shall establish construction site policy and educate all construction personnel.

B. All waste materials shall be collected and stored in a securely lidded, metal dumpster. The dumpster shall be rented from and emptied by a Georgia licensed solid waste management company. The dumpster shall meet all County and State Solid Waste Management regulations and ordinances. The dumpster shall be emptied as necessary, and the material shall be hauled to a State licensed landfill. No construction debris shall be buried on the construction site. All personnel shall be informed and instructed regarding the correct procedure for waste disposal. Notices stating these procedures shall be posted in the construction office and the construction superintendent shall be responsible for ensuring that these procedures shall be followed.

1.07 HAZARDOUS WASTE

A. All hazardous waste materials shall be disposed of in a manner specified by Georgia State Solid Management regulations. All personnel shall be informed and instructed regarding the correct procedure for waste disposal. Notices stating these procedures shall be posted in the construction office and the construction superintendent shall be responsible for insuring that these procedures shall be followed.

1.08 SANITARY WASTE

A. All sanitary waste shall be collected from the portable units, as necessary, by a Georgia State licensed sanitary waste management contractor, or as required by local regulations.

1.09 TEMPORARY FUELING TANK AREA

A. Temporary fueling tanks shall have a Georgia E.P.D. approved secondary containment (liner system) basin to prevent and/or minimize site contamination. Temporary fueling tank locations shall be located remotely from drainage ways, drainage systems, and state waters (streams, springheads, etc.).

1.10 EQUIPMENT MAINTENANCE AREA

A. Equipment maintenance areas shall be clearly identified with signage. Said signage shall read as follows:

Equipment Maintenance Area

Discharge of new or used oil, fuel, lubricants, etc. is prohibited. Utilize containment/capture systems. Recycle used oils, contaminated fuels and lubricants. Illegal discharges are subject to fines and penalties.

B. Sign shall be weatherproof and have a minimum size of 36” X 36”.

C. Equipment Maintenance Area(s) shall be located remotely from drainage ways, drainage systems, and state waters (streams, springheads, etc.).

PART 2 - PRODUCTS

2.01 CONSTRUCTION SURVEY AND LAYOUT EQUIPMENT

A. Surveyor's transit and measuring devices properly calibrated to accurately layout the work shall be used.

B. Provide stakes and batter boards of size and quality commensurate with function. Use wire or non-stretching cord to establish reference lines for site clearing and grading.

2.02 PROTECTION MATERIALS

A. Materials for protection of existing work remaining shall be of the size, strength, and extent to provide adequate protection of existing work remaining.

2.03 REPAIR MATERIALS

A. Repair materials shall be of the same or better quality and performance as materials that are to be restored. Where possible, reuse existing materials that are removed.

PART 3 - EXECUTION

3.01 SITE WORK LAYOUT AND CONSTRUCTION SURVEY

A. Bench Marks and Monuments: Before commencing work verify bench marks and all reference points. If found at variance with the drawings, notify the Design Professional immediately and prior to continuing with construction activities in that area.

B. Plainly mark all bench marks, and property corners and property lines as follows:
   1. Mark all project bench marks and mark all property corners within 100 feet of construction limits by driving a 4 foot lath with appropriate offset (not to exceed 5 feet) from property pin or monument. Paint at least the upper 8” of the lath a bright yellow and clearly label the label the lath with the bench mark number and elevation, or label “property corner” as applicable.
   2. Install 2’ lath, label “property line”, and tie a red ribbon to the lath every 50’ along property lines when project work coincides within 50 feet of property boundaries.

C. Carefully maintain all benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed, at no additional cost to the owner. Establish and maintain stakes as required for drives, parking, walks, underground vaults and structures, and other site improvements.

D. Flag or stake limits of construction and tree protection areas and install tree protection fencing to protect existing trees to remain.

E. As work progresses provide construction staking for grading (including subgrade, gravel courses, finish grade), points of curvature, points of tangency, grade changes, and for structures and miscellaneous site elements. If discrepancies between actual lines, grades, and elevations exist, notify Design professional before proceeding with layout of structure.

3.02 PROTECTING EXISTING VEGETATION TO REMAIN

A. All trees and vegetation marked to be saved or relocated shall be protected by temporary barricades, be watered and maintained where necessary, and replaced if damaged by construction. Root systems cut or damaged within work area during construction shall be pruned and protected from additional damage and covered with soil as soon as possible.

B. Under no circumstance, do not remove vegetation shown on the drawings to be saved, or marked by the Design Professional or Owner to be saved.

3.03 PROTECTING EXISTING SITE IMPROVEMENTS TO REMAIN.

A. Protect all existing curbs, sidewalks, buildings, utilities, and paving to remain.

B. If existing site improvements are damaged in performance of this work, restore such improvements without extra cost to the Owner.

3.04 UTILITY LOCATES

A. Utilities Protection Law (Dig Law): Comply with Georgia Utilities Protection Law. Notice must be given to the Georgia Utilities Protection Center; by dialing 8-1-1 or 800-282-7411 at least 48 hours but no more than 10 days preceding the day mechanized digging is to begin. This notice shall contain County (where project is located), Town (or closest City or Town), location (street address), type of work to be done, name of Contractor, company name and address, telephone number, which company/individual the work is being done for, date and time the Contractor is planning to dig. Locates are valid for 30 days. Renew or call for re-mark as necessary.

B. Secure the services of a private utility locator service <u>in addition</u> to contacting the Utilities Protection Center of Georgia. Perform Subsurface Utility Engineering (SUE) services in accordance with ASCE CI 38-02 Quality Level B: Utility Designation. Such utility designations shall be as necessary to ascertain any wet sewer lines, water supply lines, live electrical conduits, live phone lines, live gas lines and all other utilities, and shall make sure these utilities can be broken or changed without danger or disruption to any necessary service. Disconnect and de-activate all existing utilities before proceeding with the work, except as specified above or otherwise shown on plans.

3.05 DISPOSITION OF UTILITIES

A. Follow rules and regulations of authorities having jurisdiction for the respective utilities in executing work under this section.

B. Carefully locate existing underground utilities by hand excavation, potholing, vacuum excavation, or other methods. If utilities are to remain in place, provide protection from damage during construction operations.

C. Active Utilities Shown on Drawings or that are Visible Onsite: Protect from damage and remove or relocate as indicated or specified. All utilities (including but not limited to: existing utility poles, guy wires, hydrants, meters, valve boxes) within the construction area that are evident from a visual inspection of the site shall be protected or relocated as necessary.

D. Active Utilities Not Shown on Drawings or Evident from Visual Inspection: Protect or relocate in accordance with written instructions of the Design Professional. Contract Sum may be adjusted for additional work in accordance with Contract Conditions.

E. Inactive and Abandoned Utilities:
   1. Fully remove inactive and abandoned utilities only as shown.
   2. Plug, cap, abandon in place utilities as shown. In absence of specific requirements, plug or cap such utility lines at least 4 feet outside of existing building walls, excavation limits, or as required by local regulations.

F. Repair damaged utilities to satisfaction of utility owner.

G. Accurately record locations of active and inactive utilities encountered during construction operations on record drawings.

3.06 MAINTAIN EXISTING UTILITY SERVICES

A. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Do not interrupt existing utility service facilities occupied and used by Owner or others, unless written permission is given by the Design Professional and then only after temporary utility services have been provided. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.

B. Provide not less than 72 hours' notice to Owner if shutdown of service is required during a changeover.
   1. Arrange to shut off indicated utilities with utility companies.
   2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

3.07 DUST CONTROL

A. Keep airborne dust to a minimum by using water sprinkling or tossing and/or other suitable means to limit dust and dirt from rising and scattering in the air. Water all disturbed earth no later than 5 days from last rain or last watering.

3.08 POLLUTION AND SPILL PREVENTION

A. Control both air and water pollution. No tires, oils, asphalt, paint or coated metals are permitted in combustible waste piles. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials will not be discharged into or near rivers, streams or man-made channels. Equipment maintenance shall be performed with containment and capture of used oi. Do not pour or drain used lubricants or other necessary mechanical fluids onto the ground. Remove from site and deliver to a recycling center. Utilize a concrete washout area and remove washed out concrete from the site.

B. Material Management Practices
   1. The following material management practices shall be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff. Follow good housekeeping practices onsite during the construction project.
      a. An effort shall be made to store only enough product required to do the job.
      b. All materials stored onsite shall be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
      c. Products shall be kept in their original containers with the original manufacturer's label.
      d. Substances shall not be mixed with one another unless recommended by the manufacturer.
      e. Whenever possible, all of a product shall be used up before disposing of the container.
      f. Manufacturer's recommendations for proper use and disposal shall be followed.
      g. The site superintendent shall inspect daily to ensure proper use and disposal of materials onsite.

C. Hazardous Products
   1. The Contractor shall use the following practices to reduce the risks associated with hazardous materials:
      a. Products shall be kept in original containers unless they are not resealable.
      b. Original labels and material safety data shall be retained with the product by the General Contractor. They contain important product information.
      c. Surplus products shall be disposed of following and in conformance with local and State recommended methods, NPDES permit requirements, and Federal Environmental Regulations.

D. Product Specific Practices
   1. The following product specific practices shall be followed for products stored on-site:
      a. Petroleum Products:
         1) All on-site vehicles shall be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products shall be stored in tightly sealed containers that shall be clearly labeled and stored in a clearly identified area. Any asphalt substances used on-site shall be applied according to the manufacturer's recommendations.
      b. Fertilizers:
         1) Fertilizers used shall be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer shall be worked into the soil to limit the exposure to storm water. Any fertilizers that are to be stored on-site shall be stored in a protected, securable enclosure. The contents of any partially used bags of fertilizers shall be transferred to a clearly labeled sealable plastic container to avoid spills.
      c. Paints:
         1) All containers shall be tightly sealed and stored when not required for use. Excess paint shall not be discharged to the storm sewer system but shall be properly disposed of according to local and State regulations.
      d. Concrete:
         1) Concrete trucks shall be allowed to wash out, discharge, and drum wash only at the identified equipment maintenance area(s). Maintenance areas shall be equipped with a discharge containment area (e.g., earth berms surrounding area). The containment area shall be cleaned up and removed from the site upon completion of concrete installation work.

E. Spill Prevention and Cleanup
   1. The following practices shall be followed for spill prevention and cleanup:
      a. Local, State, NPDES, Federal Environmental, and Manufacturer's recommended methods for spill cleanup shall be clearly posted and site personnel shall be made aware of the procedures and the location of the information and cleanup supplies.
      b. Materials and equipment necessary for spill cleanup shall be kept in the material storage area on-site. Equipment and materials shall include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, respirators, cat litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
      c. All spills shall be cleaned up immediately upon discovery.
      d. The spill area shall be kept well ventilated and personnel shall wear the appropriate protective clothing to prevent injury from contact with a hazardous substance.
      e. Spills of toxic or hazardous material shall be reported to the appropriate local or State government agency, regardless of size.
      f. A spill prevention plan shall be implemented or adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures shall also be included.
      g. The General Contractor shall be responsible for assigning personnel to be responsible for spill prevention and cleanup coordination. The General Contractor shall designate, at a minimum, three site personnel to receive spill prevention and cleanup training. These individuals shall each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel shall be posted in the material storage area and in the on-site construction office.

3.09 WASTE MANAGEMENT

A. Clean and remove trash and debris on entire site, including trash and debris deposited from previous operations.

B. During construction, maintain a clean and orderly worksite. Do not dump or store debris on any part of the property unless authorized in writing by the Owner and Design Professional. Debris may include but is not limited to: trash, construction material, cleared vegetative matter, and boulders.

3.10 FINAL CLEAN UP

A. Remove Contractors office trailer, storage shelters, stockpiled materials, and equipment from the site.

B. Remove all remaining debris, or any other extraneous material deposited during construction from the site including all graded areas, and other undisturbed areas. All debris is the property of the Contractor and shall be hauled away from the site and disposed of lawfully.

C. Clean, sweep and wash the entire site, including areas outside of the “limits of disturbance” for final inspection. Provide required lawn maintenance to provide complete and finished appearance. Leave the site in a neat and orderly fashion for use by the Owner.

END OF SECTION

SECTION 31 00 02
SITE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Demolition of buildings and below grade foundations.
   2. Selective demolition of buildings and other site features.
   3. Demolition of existing site elements.
   4. Protection of existing site elements to remain.
   5. Disposal of demolished materials.

B. Related Sections:
   1. 31 00 01 “SITE PREPARATION AND GENERAL SITE WORK” for protection of existing facilities, protection of vegetation, utility locates, and utility protection, and maintenance of active utility service to portions of existing facilities schedule to remain open and in service during construction.

1.02 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be salvaged, or to remain the Owner’s property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner’s property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner’s designated storage area.

C. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Design Professional, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in the original locations.

1.03 SUBMITTALS

A. Prior to demolition work, submit the following for information only.
   1. Proposed dust control measures.
   2. Proposed noise control measures.

B. Schedule Selective Demolitions Activities Indicating the Following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Arrange selective demolition schedule so as not to interfere with Owner’s on-site operations.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner’s on-site operations.
   5. Coordination of Owner’s continuing occupancy of portions of existing building and of Owner’s partial occupancy of completed Work.
   6. Locations of temporary partitions and means of egress.

C. Inventory of all items to be removed and salvaged.

D. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damaged caused by demolition operations.

E. As applicable, records indicating receipt and acceptance of solid waste and hazardous wastes by legal and licensed facilities to accept such wastes.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with hauling and disposal regulations of Georgia EPD (Environmental Protection Division) and other authorities having jurisdiction.
2. Comply with applicable demolition requirements of local jurisdictions and the State of Georgia.
3. Comply with the requirements of NFPA 241, 2013 Edition, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.05 SITE CONDITIONS

A. Cooperation with the Owner in phasing the work to accommodate existing site users is of the essence. The Owner will occupy portions of the site / building adjacent to demolition areas as noted below:
   1. Adjacent tennis courts
   2. Restroom Pavilion

B. Conduct selective demolition so that the Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

C. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

D. Storage or sale of removed items or materials onsite will not be permitted.

E. All existing curb and gutter, paving, structures, utilities and all other existing items that are located where proposed items are to be built but are not shown specifically for removal, shall be removed only when approved in writing by the Owner or Design Professional.

PART 2 - PRODUCTS

2.01 REPAIR MATERIALS

A. Use Repair Materials Identical to Existing Materials. Except that where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible and as approved by the Architect.

B. Additionally, use repair materials whose installed performance equals or betters that of existing materials.

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform public and private utility locates in accordance with Section 31 00 01 "Site Preparation and General Site Work." Disconnect and de-activate all existing utilities before proceeding with the work, except as specified herein or otherwise shown on plans.

B. Verify that utilities have been disconnected and capped.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

E. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Design Professional.

F. Evaluate the condition of site structures to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

3.02 SAFETY AND PROTECTION

A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and

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

B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide all barricades, guards, lights and other installations required.
   2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
   3. Ensure safe passage of people around demolition area
   4. Protect existing site improvements, appurtenances, and landscaping to remain.

3.03 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt.
   1. Do not use water to the extent that may result in damage to existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.04 DEMOLITION

A. Demolish and remove from site the existing structures, curb & gutter, slabs, walks, paving, steps, and any other item above or below ground that interferes with construction of the project as shown on plans.

B. Remove existing curbs, gutters, slabs, and concrete walkways at the nearest contraction or expansion joint.

C. Provide neat and straight sawcutting as shown on the Plans and as required to provide selective or partial demolition.

D. Where portions of concrete slabs-on-grade are to be removed, first outline the portion with a concrete saw to a depth of at least 1/3 of the thickness.

E. Completely remove below grade construction, including foundations and footings.

F. Contractor is to coordinate the subsurface demolition with any phased utility demolition and construction. The demolition of below grade items shall not interrupt any existing or proposed utility services.

3.05 FILLING BELOW-GRADE AREAS AND VOIDS

A. Completely fill below-grade areas and voids resulting from demolition of structures.

B. Use only clean, non-frozen, and approved fill material, stone, gravel, or sand that is free from deleterious materials. Refer to Section 31 22 00 “EARTHWORK” for general fill or structural back fill.

C. Grade completed surface to drain and to meet adjacent contours.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Send recyclable waste such as asphaltic concrete, Portland cement concrete, plastic, and metals to applicable recycle centers when feasible.

C. Burning: Do not burn demolished materials.

D. Burying: Do not bury materials onsite unless approved or otherwise shown.

E. Disposal of Regulated Materials (in accordance with GDNR, EPD rules):
   1. Organic debris such as stumps, limbs, leaves, may be taken to a permitted solid waste landfill or to a permitted inert landfill.
   2. Dispose of other non-hazardous trash and debris to a municipal solid waste landfill.
   3. Dispose of oils, solvents, fuels, untreated lead paint residue and other solid hazardous wastes in properly licensed hazardous waste disposal facility.

F. Obtain all necessary permits for disposal. Transport demolished materials off Owner's property and legally dispose of them. Provide copies of disposal certificates to the Design Professional.

3.07 REPAIRS AND PATCHING

A. Repair excess demolition.

B. Employ skilled workmen to perform repair work.

C. Where installation of similar new work is included, perform repairs in manner specified for installation of new work.

D. Where similar new work is not included in the project, perform repairs using approved materials that are appropriate to the repair and, where practicable, are identical to the existing materials being repaired.

E. Restore exposed finished patched areas in a manner, which eliminates evidence of repairs.
   1. Continuous surfaces: Extend refinish to nearest intersection, with a neat transition to adjacent surfaces.
   2. Assemblies: Refinish entire unit.
   3. Painted piping, conduit and duct: Clean and repaint.

3.08 CLEANING

A. Remove tools and equipment. Dispose of scrap.

B. Leave exterior areas free of debris.

C. Existing structures and site features to remain shall be returned to the condition prior to the commencement of construction.

D. Sweep remaining hard surfaces on completion of selective or partial demolition operations.

E. Change filters on air-handling equipment on completion of selective or partial demolition operations.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Clearing of vegetative matter and debris.
   2. Grubbing.
   3. Disposal of cleared and grubbed material.

B. Related Sections:
   1. 31 00 01 “SITE PREPARATION AND GENERAL SITE WORK” for layout, public safety, protection of existing facilities, protection of vegetation, utility locates, and utility protection.

1.02 SITE CONDITIONS

A. Tree save and protection of existing vegetation: Unless approved in writing by the Design Professional clearing operations and equipment shall be limited to the “Limits Of Work Area”, “Limits Of Disturbance”, and “Tree Protection Limits” as shown on the drawings.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that utilities have been disconnected and capped as necessary for clearing activities and that clearing limits and tree protection areas are plainly marked.

3.02 CLEARING

A. Strictly adhere to the phased clearing plan as shown on the “Land Disturbance Construction Activity Sequence” Erosion and Sedimentation Control Plan. Only upon completion of initial inspection by the Design Professional shall the contractor expand his clearing and grubbing operations to the entire site.

B. Clear all areas to be graded of remaining debris and extraneous materials.

C. Remove from the general construction /grading areas and proper disposal of all trees, brush, stumps, logs, grass, weeds, roots, decayed vegetable matter, refuse dumps, and all other objectionable matter resting on the original ground surface or appearing or being placed on these areas at any time before final acceptance of the work, except as provided for elsewhere.

D. Remove and properly dispose of any remaining obstructions not to be salvaged or preserved, such as fences and poles, and incidental structures within the construction area.

3.03 GRUBBING

A. Grubbing includes the removal and proper disposal of all stumps, roots, and other vegetation or perishable matter that exists below the original ground surface in cleared areas. Grubbing also includes removal of general buried obstructions, trash, and debris not otherwise removed by demolition.

B. Unless otherwise shown, grub to the following depths:
   1. All sound, unsound or decayed stumps shall be removed to a depth of 2 feet below the original ground.
   2. Under lawn, planting, or sportsfield areas: Grub to a depth of at least 2 feet below finish grade.
   3. Under asphalt, concrete, and gravel pavements: Grub to a depth at least 2 feet below subgrade elevation.
   4. Under foundations, slabs, and structures: Grub to a depth of at least 3 feet below the foundation of proposed structures.
   5. For other areas: Remove to a depth of at least 1 feet below natural ground surface.

3.04 DISPOSAL OF MATERIALS

A. The removal and disposal of all cleared and grubbed materials is the responsibility of the Contractor.

B. Contractor may utilize a tub grinder for grinding of clearing operation organic debris. Organic mulch produced may be spread and utilized on cut and fill slope upon reaching finished grade for erosion and sedimentation control purposes. All other debris from clearing and grubbing operations shall be disposed of offsite, unless approved otherwise by the Owner and Design Professional.

C. Comply with all local ordinances and obtain any necessary permits if applicable for disposal of trees, stumps, and other debris. Refer to Section 31 00 02 “Site Demolition” for disposal of debris.

END OF SECTION

SECTION 31 22 00
EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Temporary grading or ditching to protect the site and adjoining property from water and silt damage.
   2. Topsoil Stripping.
   3. Grading, excavating, rock excavating, and filling to prepare subgrades for foundations (buildings and structures), walks, pavements, grass areas, landscape areas, and general areas.
   4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:
   1. 31 00 01 “SITE PREPARATION AND GENERAL SITE WORK” for layout, protection of existing facilities, protection of vegetation, utility locates, and utility protection.
   2. 32 05 00 “Common Works for Exterior Improvements” for import fill, import backfill, geotextile specifications.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Georgia Department of Transportation (GDOT)
   1. Department of Transportation, State of Georgia Standard Specifications, Construction of Roads and Bridges, 2013 Edition. Unless otherwise noted, conform with GDOT Standard Specifications where referenced.
   2. GDOT Test Procedures (GDT), where referenced.

B. American Society for Testing Materials (ASTM)
   1. ASTM D422 - Particle Size Analysis of Soils.
   2. ASTM D423 - Test for Liquid Limit of Soils.
   3. ASTM D424 - Test for Plastic Limit and Plasticity Index of Soils.
   4. ASTM D1556 - Test for Density of Soil In Place Sand Cone Method.
   5. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification).
   6. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   7. ASTM D698 - Standard Test Methods For Moisture-Density Relations of Soil Using Standard Effort.
   8. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.03 DEFINITIONS

A. Backfill is defined as fill immediately behind foundation elements or retaining walls.

B. Excavation: Removal of material encountered above subgrade elevations, and to lines and dimensions indicated, or as directed. Excavation may be classified as earth excavation, rock excavation, or subexcavation, or it may be *unclassified* as described below.
   1. Unclassified Excavation: Excavation of all material, including rock, regardless of its nature or the manner in which it is removed. All excavation shall be unclassified unless explicitly and otherwise shown on the Drawings, or if unit pay items are provided for Rock Excavation, Earth Excavation, or SubExcavation.
   2. Earth excavation or simply “Excavation”: Excavation of all material is except for active utilities and rock.
   3. Rock excavation: Excavation of all hard, compacted, or cemented materials that require the use of drilling, blasting or wedging equipment to remove. It shall consist of un-decomposed stone hard enough to ring under a hammer, and the amount of solid stone

shall not be less than one (1) cubic yard in volume. If applicable, rock is further defined as follows:

a. General Excavation (Mass): Any material occupying an original volume of more than one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds (Caterpillar D-8 or larger).

b. Trench Excavation: Any material occupying an original volume of more than one cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC 220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

4. Subexcavation: Authorized additional excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Design Professional or Testing Agency in writing.

C. Fills: Suitable materials placed to raise existing grades. All fill material placed on site by the contractor, regardless of whether fill is from on-site or off-site sources, cannot, by its nature, be classified as unsuitable soils. Contractor is responsible for dewatering or drying out of water saturated soils to the extent necessary to satisfy the requirements for fill.

1. General area fill: all fill in the general grading area covering banks, hollows, drain ditches, etc.
2. Pavement fill zone: The zone occupied by materials supporting asphalt or concrete paving supporting vehicular traffic or parking and extending for a distance of 4 feet on each side paving area measured at the finished grade (including gutter pans), thereafter tapering away at a 45° angle. Pavement fill zone for asphalt or concrete pedestrian areas are 2 feet on each side of paving area measured at finish grade and tapering down at a 45° angle.
3. Structural fill zone: The zone occupied by materials supporting floor slabs, building foundations or other structures and extending for a distance of 10 feet on each side of said structure measured at the finished grade, thereafter tapering away at a 45° angle.

D. Neat line: The shown, directed or described line or plane defining the limits of work. Work beyond neat line(s) is not subject to payment when included in a unit pay item.

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

F. Trenches: Foundation: The area beneath the bedding.

1. Bedding: The area above the foundation and below the bottom of the pipe.
2. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
3. Initial backfill: The area above the haunching material and below a plane 18 inches above the top of the pipe.
4. Final backfill: The area above a plane 18-inches above the top of the barrel of the pipe.

G. Conserved Topsoil: Excavated soil material, with organics, conserved from grading areas that is suitable for growth of grass, cover crops, or planting areas. Identification and use of all conserved topsoil is subject to approval by the Testing Lab or Design Professional. Refer to 32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVMENTS” for definition of Furnished Topsoil.

H. Unsuitable Soils: Those materials determined by the Testing Laboratory or Design Professional to be unsuitable for use in a particular application for reasons other than moisture or water content. In general, existing undisturbed soils that are highly organic or highly plastic (classified as Class IV Roadway Material per Georgia DOT Standard Specification Section 810) may be classified as unsuitable depending on application.

1. Water saturated soils, regardless of the source of the water (rainfall, storm runoff, ground water or other sources) shall not be considered as unsuitable.

1.04 UNIT PRICES

A. Rock Excavation: Unit prices for rock excavation include replacement with approved materials. Measurement of rock excavation shall be based on the volume of rock actually removed, measured in its original position, but not to exceed the following (payment neat lines).
   1. 2.0 ft outside of concrete forms other than at footings.
   2. 1.0 ft outside of concrete forms at footings.
   3. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   4. 6 inches beneath bottom of concrete slabs-on-grade.
   5. 6 inches beneath pipe in trenches, and 2.0 ft wider than pipe but not less than 3.0 ft wide.

B. Sub Excavation: Unit prices for subexcavation shall include replacement of unsuitable material with geotextile for separation and approved backfill material. Volumetric measurement of subexcavation is based on neat line quantities as directed or approved by the Design Professional or Testing Agency.

C. Import Fill Material: Unit prices for import fill (structural fill, general fill when shown and not including any fill material for rock excavation or subexcavation) shall include disposing of any unsuitable material, procuring fill materials and transporting them to the site.
   1. Unless otherwise specified in the General Conditions, when mass measurements are shown on the bid form, measurement of additional import material are based on weight tickets for material delivered to the site and incorporated into the work.
   2. Unless otherwise specified in the General Conditions, when volume measurements are shown on the bid form, measurement shall be based on volumes measured in the truck or transporting vehicle

1.05 SUBMITTALS

A. Product data for materials, including but not limited to: geotextiles, utility line markers, import fill material, control density backfill.

B. Quantities of stripped and stockpiled topsoil. Provide report within 48 hours of stockpiling.

C. Shoring, bracing and shielding plans and calculations by a Professional Engineer registered in the State of Georgia.

D. Settlement monitoring reports for structural fills.

E. Backup for unit cost documentation, that may include:
   1. Survey and computed quantities for Rock Excavation.
   2. Delivery tickets (tonnage) for import fill incorporated into the Work.

F. Field and laboratory test or quality control results including, but not limited to, the following:
   1. Subgrade proctor, compaction, moisture content.
   2. Gradation, proctor, compaction, moisture content for fill or backfill material.
   3. Proof rolling and other qualitative inspection reports.

G. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earthwork operations including blasting. Submit before earth moving begins.

1.06 QUALITY ASSURANCE

A. Earthwork Testing and Inspection Services: The Owner will engage a qualified independent Testing/Inspection Agency to perform Earthwork Testing as described in this Section.

B. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare an informational blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.
3. Pre-excavation photos or videotape.

1.07 SITE CONDITIONS

A. Protection:
1. Limit grading and filling operations to within the defined clearing limits, work zones, or limits of disturbance. Do not disturb the existing terrain or trees outside these lines.
2. Fill material placed against drainage structures or back-filled around utility pipes shall be placed and compacted by methods which will not cause any damage. Any damage which does occur shall be repaired or replaced by the Contractor at the Contractor's expense.
3. Graded Areas: Any settlement or washing that occurs prior to acceptance of the work shall be repaired and grades re-established to the required elevations and slopes. Fill to required subgrade levels any areas where settlement occurs.

B. Hazardous Materials:
1. No soil found on site or transported to the site which is contaminated with material containing asbestos, PCB's, radon, gasoline, fuel oil, or other fossil fuels, shall be used for fill, backfill or landscape topsoil.
2. Notify Design Professional of any contaminated soil found on site. Any contaminated soil found on site shall be removed and disposed of in a lawful manner. Any unknown contaminated soil removal and disposal may be subject to Contract Change Order provisions or unit prices if present.

1.08 COORIDINATION AND SCHEDULING

A. Notify the Design Professional a minimum of 48 hours prior to the beginning of any excavation, filling, or grading.

B. The Contractor is solely responsible for the scheduling and sequencing of the work. If necessary, to maintain the contractor's schedule, removed wet soils dewater and dry out sufficiently for its application, or remove and replace with suitable fill. The dewatering or removal and replacement of water saturated soils shall be performed at the contractor's expense.

PART 2 - PRODUCTS

2.01 FILL OR BACKFILL MATERIALS

A. The soil used for fill or backfill material shall be free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Fill or backfill for paving areas or supporting buildings shall have a maximum dry density exceeding 90 pounds per cubic foot (pcf).

C. Where specified use Graded Aggregate Base (GAB) as backfill or structural fill: Refer to 32 05 00 "Common Works for Exterior Improvements" for material properties.

D. Structural Fill: Soil Classification Groups SM, ML, CL; SW, SP, SC, SP-SM, SP-SC.) Structural Fill: Soil Classification Groups GW, GP, GM, SM, ML, CL; SW, SP, SC, SP-SM, SP-SC. (ASTM D 2487). Additionally, Class I or Class II (but excluding Class IIB4) Roadway Materials (GDOT Section 810.01) are also acceptable for Structural Fill.
1. Structural fill material exhibiting a wide variation in consistency and or moisture content shall be blended and/or aerated to stabilize and upgrade the material.

E. Permeable Backfill: Unless shown otherwise, provide a minimum of 2 horizontal feet of permeable backfill material behind retaining structures consisting of gravel, crushed rock, natural sands, manufactured sands, or combinations of these materials conforming to the following gradation:

Sieve Size	Percent Passing
3/4 inch	100
3/8 inch	0-100
No. 100	0-8
No. 200	0 -3

Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

F. General Fill: Includes soils suitable for structural fill as well as other onsite non-organic and non-expansive soils that are approved by the Design Professional or Testing Agency that will form a stable and dense mass with or without confinement.

2.02 UTILITY EARTHWORK MATERIALS

A. Foundation Material: Unless otherwise specified, Crushed stone meeting GDOT Standard Specification 800.01, Group 1 (limestone, marble, or dolomite), or Group II (quartzite, granite, or gneiss). Stone size is between No. 57 and No. 4, inclusive.

B. Utility bedding and backfill: Unless otherwise shown bed pipes from trench bottom to one foot above pipe.
   1. Unless otherwise shown pipe bedding and backfill shall consist of: sand, gravel, crushed aggregate, or native free draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
   2. Cement sand slurry shall be provided with 1 sack of concrete per cubic yard of mixture.
   3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

2.03 LINE MARKERS

A. 2” width minimum, 5 mil tape thickness with non-ferrous detectable aluminum backing and shall be printed with the description that the relevant utility is “buried below”. Line marker colors according to APWA corresponding to the utility type as follows:
   1. Gas lines- yellow
   2. Power – red
   3. Communications - orange
   4. Sanitary – green
   5. Water - blue

2.04 GEOSYTHETICS

A. Refer to 32 05 00 “Common Works for Exterior Improvements” for material properties of geotextiles for separation and stabilization.

PART 3 - EXECUTION

3.01 PREPARATION

A. Construction Survey: Refer to 31 00 01 “Site Preparation and General Site Work” for layout and survey requirements. Provide construction staking as required for drives, parking, walks and other site improvements. Protect benchmarks, monuments and other reference points.

B. Clear and grub the area of vegetation and obstructions.

3.02 EROSION CONTROL AND SEDIMENT CONTAINMENT SYSTEMS

A. Adhere to the “Land Disturbance Construction Activity Sequence” as defined in the Erosion and Sediment Control Plans.

B. Temporary Grading and Drainage: Provide effective drainage for the entire site at all times. Divert watersheds by ditching or embankments to prevent encroachment of surface water in excavations. No impoundment of water will be permitted except as provided. The Contractor is fully responsible for all water damage to the site and to the installed work.

C. Refer to 31 25 00 “EROSION & SEDIMENT CONTROLS” for additional grading operation requirements and storm drainage system installation requirements.

3.03 CONSERVED TOPSOIL

A. After all demolition, clearing and disposal is completed, strip from the top of the existing ground all topsoil from all areas to be graded.

B. Prior to stockpiling of topsoil, screen topsoil via a mobile mechanical screening machine with a 1/2inch size sieve.

C. Stockpile topsoil in designated or approved locations with proper drainage and where it will not interfere with the work. After topsoil has been stockpiled, quantify the stockpiled volumes. Report quantities to the Design Professional, Owner and Site Design Professional within 2 days of completing stockpiles.

D. Refer to Division 32 Sections “TURFS AND GRASSES” and “PLANTING PREPARATION” for stockpiled topsoil application requirements and additional amendment requirements for turf, lawn, and planting areas.

1. If amount of conserved topsoil is insufficient to provide the necessary amounts as indicated in the Drawings and specifications, it is the Contractor’s responsibility to furnish topsoil (from off-site sources) the necessary amount of topsoil, of the specified quality, to complete the project.

E. Excess topsoil distributed onsite: After completion of topsoil application in lawn areas, planting areas and other areas shown on the Drawings, distribute any remaining topsoil to general disturbed areas as agreeable to the Owner and Design Professional. Distribute excess topsoil to a minimum depth of 4 inch. Scarify ground to a 4” depth before placing topsoil.

F. Excess topsoil hauled: After completion of topsoil application in lawn areas, planting areas and other areas shown on the Drawings, any excess topsoil becomes the property of the Contractor and shall be hauled off site.

3.04 GENERAL GRADING REQUIREMENTS

A. Perform exterior grading to provide smooth transitions to and between the proposed contours and spot elevations shown on Drawings.

B. In all cases, grade to a sufficient pitch to drain water.

C. Perform earthwork as required to establish finished grades as indicated on drawings. Grades not otherwise indicated shall be uniform levels of slopes between points where elevations are given or between such points and existing finished grades.

D. Excess Cut Material: If quantity of grading material is in excess of quantities necessary to provide finish grade elevations indicated on drawings or if excavated material is deemed

unsatisfactory for use as compacted fill, excess material is hauled off site and disposed of legally. Hauling and disposal of excess cut material is performed at the Contractor's expense.

E. Insufficient Fill Material: If quantity of grading material is insufficient to achieve subgrade elevations, Contractor shall obtain additional fill material of specified quality from an off-site source. Obtaining and hauling of additional fill material is performed at the Contractor's expense.

F. Import Fill Material for Areas Determined to be Unsuitable: If the Design Professional or Testing Agency determines that onsite excavated or grading materials are unsuitable for use as compacted fill for a given application, then import fill material is obtained from an off-site source. Import fill material shall conform to specifications for the given application. Disposing of unsuitable material, and providing, hauling of import fill material shall be performed by change order based on the unit prices included within the contract.

G. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value. All moisture conditioning necessary to permit compaction to the specified density is performed at the Contractors expense.

H. Slope subgrade to provide positive drainage within all underdrain systems. Unless shown otherwise on the Drawings, subgrade minimum slope to underdrain collection systems is 0.5%.

I. Subgrade Elevation Tolerance: Cut, place, compact fill and rough grade entire project area to within 0.10 feet above or below design subgrade elevations.

3.05 EXCAVATION AND EMBANKMENT SAFETY

A. Comply with all Federal, State, and Local safety laws and regulations pertaining to trenching, excavation, bracing and shoring that includes but is not limited to:
   1. OSHA Excavation Standards, 29 Code of Federal Regulations (CFR) Part 1926, Subpart P- Excavations.

B. If conflict exists between safety laws, regulations, and contract requirements including these specifications, apply the most stringent requirements or standards.

C. Protect all excavations and embankments against collapse. Where possible, excavations over 4 feet high shall be made at a slope not steeper than 1. 5H:1V or where the soil is very sandy or wet the slope should be no steeper than 2H:1V.

D. Barricade trenches, ditches, pits, sumps and similar Work outside the barricaded working area with chain link fence and in accordance with OSHA standards and requirements.

E. Where it is not possible to provide a safe slope, temporarily support all banks and excavations and maintain secure until permanent support has been provided.

F. Where ditches or trenches that are over 4 feet deep, provide cross bracing and shoring to prevent collapse.

G. Provide bracing, shoring, or shielding systems designed by a Georgia Registered Professional Engineer experienced in such designs. The design drawings shall show the work and sequence in its entirety and be submitted to the Design Professional prior to commencing the work.

H. Remove shoring upon completion of Work, or when no longer need, unless otherwise required by authorities having jurisdiction over the Work.

3.06 DEWATERING

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

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

C. Maintain groundwater a minimum of 3 feet below the bottom of any excavation associated with a foundation. Maintain all excavations free of standing water at all times.

D. Remove all mud caused by standing water from any excavation before the placing of permanent material.

E. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. 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.

F. No untreated sediment laden water from dewatering operations shall be allowed to enter surface water or a storm drainage system or a permanent stormwater pond.

3.07 TRENCH EARTHWORK

A. General:
   1. Conform with the most stringent requirements of these specifications, the Plans, of Utility providers, and of local agency permitting authorities. Requirements may include, but are not limited to: depth of cover, minimum trench width, bedding material, pipe zone backfill, and compaction requirements.
   2. Detection wire: Bury continuous and unbroken wire directly above non-metallic piping at a distance not to exceed 12 inches above top of pipe. Terminate wire in junctions (manholes, vaults, boxes) with a minimum of 3 feet of wire coiled, remaining accessible in each manhole.
   3. Line Markers: During back filling of utility lines, furnish and install continuous underground-type plastic line marker, located directly over buried utility lines at 12” below finished grade. Under pavements and slabs, bury tape 6” below top of subgrade.
   4. Do not exceed 100 feet of open trench in advance of pipe laying, unless approved otherwise by the Design Professional.

B. General Trench Excavation:
   1. Saw cut concrete or bituminous paving for trench excavation.
   2. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns
   3. Excavate trenches to the required depth or elevation allowing for placement of the pipe and bedding to the dimensions shown on the Drawings.
   4. Grade bottom of trenches, no larger than necessary, to accommodate bell holes and other joints and junctions to provide uniform bearing along the pipe.
   5. At the direction of the Design Professional or Testing Agency remove unstable or unsuitable material shall be removed from the bottom of the trench and backfilled in accordance with Article – “SUBEXCAVATION”.
   6. When rock is encountered, excavate to allow a minimum of 6 inches of clearance between rock and any part of the pipe barrel or structure (manhole, vault) and backfill with granular bedding material.
   7. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footings.
   8. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Pipe material / use	Cover depth (below finish grade)

Steel Pipe	24 inches
Copper Water Tube	18 inches
Cast-Iron Pressure Pipe	36 inches
Plastic Pipe (other than waste)	30 inches
Tanks or other structures	36 inches
Soil, Sewer & Storm Drain	18 inches (min.) and as required for proper pitch and traffic load. Plastic pipe shall have a min. 18” cover.
Irrigation Pipe	12 inches (Non-pressure) 18 inches (Pressure)

C. Utility Trenches (except sanitary and storm sewer):
   1. Excavate to a width as necessary for sheeting and bracing and proper performance of the Work.
   2. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.
   3. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.
   4. Do not install backfill until required inspections and testing is completed.
   5. Bed and provide initial backfill in accordance with the Drawings, and authorities having jurisdiction.
   6. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.

D. Sanitary and Storm Sewer Trenches:
   1. The maximum trench width below a plane 6 inches above the top of pipe is:
      a. 24 inches for pipe diameters of 12 inches or less.
      b. Equal to the sum of the outside diameter of the pipe plus 2 feet for pipe diameters greater than 12 inches.
   2. Excavate the trench width to allow for the proper compaction of haunching and initial backfill material.
   3. Excavate the width of trench above a plane 6 inches above the top of pipe as necessary for proper performance of the work including any sheeting, bracing, or shielding.
   4. Bed bottom of pipe on suitable undisturbed soil or as otherwise shown on the Plans.
   5. In haunch areas of plastic pipe, install granular fill bedding material up to the springline of the pipe.
   6. Install initial backfill in lifts not to exceed 6 inches loose, compacted to 95% of modified proctor and to a minimum depth of 12 inches above the top of pipe. Unless otherwise specified or required by authorities having jurisdiction, immediate backfill material is as follows:
      a. Class 1- Granular fill.
      b. Class 2- Suitable existing earth material (default).

E. Final Fill
   1. Once outside of the initial backfill area, continue backfilling to reach subgrade elevation as follows:

a. For utility trenches in paving and building areas: Provide structural backfill in 6-8" loose lifts, compacted to 95% of standard proctor, and within +- 3% of optimum moisture. Except that for structural backfill within 24 inches of subgrade, provide in 4" loose lifts and compact to 98%.
b. Where required, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.
c. For utility trenches in general fill areas or grading areas: Provide general fill in 8" loose lifts, compacted to 90% of standard proctor and within +-3 % of optimum moisture to reach subgrade elevation.

2. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Division 32 "FLEXIBLE AND RIGID PAVING REPAIR".

3.08 EXCAVATION

A. Excavate to lines, elevations, dimensions, and depth as indicated on the drawings.

B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other Work as required. Excavation bottoms shall be level and free from loose material.

C. Machine drill excavation for round footings to size and depth indicated. Provide a collar, casing, or other adequate protection to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.

D. Excess Excavation: If excavations for foundations or footings of any kind are carried by the Contractor, without proper authorization, below the indicated or specified levels they shall be backfilled at the expense of the Contractor as follows:
1. In the areas of excess excavation in rock or under structure footings, the excess excavation shall be back filled with control density fill.
2. In the areas of excess excavation in other areas, backfill with approved structural or fill material and constructed in accordance with the fill articles in this Specification.

E. Earth Excavation:
1. **Surface Preparation in excavated areas for foundations:** scarify and uniformly recompact the upper 24 inches of soils intended to support building foundations and floor slabs to 98% of Standard Proctor (ASTM D 698). In confined areas such as utility trenches, utilize portable compaction equipment and lifts of 3 to 4 inches to achieve the required compaction.
2. **Surface Preparation in excavated areas for paving areas:** scarify and uniformly recompact the upper 12 inches of soils to 95% of Standard Proctor (ASTM D 698). In confined areas such as utility trenches, utilize portable compaction equipment and lifts of 3 to 4 inches to achieve the required compaction.
3. **Surface Preparation in infiltration areas, planting bed areas**: unless otherwise shown, scarify and uniformly recompact the upper 12 inches of soils intended for planting areas or infiltration to 75-80% of Standard Proctor (ASTM D 698) to prevent settlement but still allow for infiltration and plant growth.
4. Do not excavate to full depth when freezing temperature may be expected. Protect excavation bottom from frost if placing of concrete or gravel is delayed. All footing excavations shall be free of pin roots.

F. Rock Excavation:
1. When potential rock is encountered, remove overburden soils and notify the Testing Lab or Design Professional prior to **any** rock excavation. The Testing Lab or Design Professional shall approve and classify all rock excavation. Once classified, survey grading sections of existing rock surface. When rock is completely removed, survey new grading sections to determine the quantity of rock removed within neat line limits**.**

2. Perform all blasting in accordance with local ordinances and obtain necessary permits where required.
3. Rock that is excavated is the property of the Contractor and shall be removed from the site. Except that, as allowed by the Contract Documents or as approved in writing by the Testing Agency or Design Professional, rock may be incorporated into the Work if it is processed appropriately or meets material specifications.
4. Decomposed rock and similar material removable by tractor drawn ripper or power machinery smaller than defined for rock excavation is classified as earth excavation.

3.09 PROOFROLLING

A. Proofroll surfaces when specified to check for pockets of soft material in areas associated with buildings and pavements.

B. Proofrolling subgrades within +- 3 % of optimum moisture or as approved by the Design Professional. In all cases, proofroll subgrades free of surface water which may promote degradation of an otherwise acceptable subgrade.

C. Proofroll with a loaded 20-ton dump truck, or other pneumatic-tired vehicle of similar size and weight, operated at 2 to 3 mph. For large areas such as parking lots, proof roll with 2 complete coverages in each of two perpendicular directions.

D. Perform proofrolling under the observation of the Testing Agency or Design Professional. Provide notification 48 hours in advance of all proofrolling operations. Undercut (or subexcavate) Any areas which "pump" or permanently rut under the wheels of the loaded truck and undercut (subexcavate) to a depth and extent directed or confirmed by the Design Professional or Testing Agency.

3.10 SUBEXCAVATION

A. Perform subexcavation below existing ground elevations or subgrade elevations as and when directed by the Design Professional or Testing Agency to correct areas with unsuitable bearing capacity or materials.
   1. Remove and dispose of unsuitable soils to the extents and depth as directed by the Design Professional or Testing Agency.
   2. Level and clear the bottom of the sub excavation of loose material.
   3. Place separation geotextile with all seams overlapped at least 2 feet.
   4. In paving and foundation areas, backfill with GAB (Graded Aggregate Base) in 8 inch loose layers and compact to at least 95% of Modified Proctor.

3.11 FILLING AND BACKFILLING

A. STRUCTURAL FILL –BUILDING AND RETAINING WALLS
   1. Construct structural fills in areas supporting buildings and retaining walls to establish design subgrades.
   2. Provide fill materials as specified in Part 2- Products. If excavated materials from the project site are not of required quality or sufficient quantity, import additional materials as necessary.
   3. Schedule construction of structural fill as early as possible in order to allow settlements of underlying soils to occur before building and retaining wall construction commences.
   4. Surface Preparation for fill: Bench areas to receive fill to a minimum of 12 ft width, remove all loose material, and proofroll prior to beginning fill operations.
   5. Place structural fill material in 6 to 8 inch loose lifts at a moisture content at the time of compaction within 3% of the optimum moisture content. Unless otherwise shown, compact to a minimum of 98 percent of Standard Proctor (ASTM D 698). Compact the upper 24 inches to 100 percent of Standard Proctor.

B. STRUCTURAL –BACKFILLING
   1. After concrete has been placed, forms removed and concrete work inspected, backfill excavations to indicated or required grades. Backfill simultaneously on each side of walls

or grade beams. Remove rubbish debris or other waste material from excavations prior to backfill placement.

2. Before placing any backfill, adequately cure concrete and provide bracing to stabilize structures. Protect waterproofing or damp proofing against damage during backfilling operations with required protection board. Remove bracing as backfill operations progress.
3. Install each layer of material not to exceed thickness of 6 inches, unless otherwise required.
4. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished.
5. Carefully backfill walls. Do not utilize heavy equipment within 10 feet of any retaining wall. Use hand tampers to compact within the 10 foot backfill zone.
6. Install wall backfill before installing railings and fences on walls.
7. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep hole opening. Provide an 8 inch square section of galvanized or aluminum screen with a minimum wire diameter of 0.03 inch and install at the backside of each weep hole before installing the backfill material.
8. If a reviewed, approved drainage matting system is provided in lieu of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

C. STRUCTURAL FILL – PAVED DRIVE, WALKS, AND PARKING AREAS
1. Load, haul, place, grade, and compact all necessary structural fill to establish design grades as shown.
2. Surface Preparation for fill: Bench to a minimum of 12 ft widths, all loose material removed, and proof roll prior to beginning fill operations.
3. Place structural fill material in 6 to 8 inch loose measure lifts with moisture content at the time of compaction within 3% of optimum. Compact to a minimum of 95% of Standard Proctor (ASTM D 698). Compact the upper 12 inches to at least 98% of Standard Proctor.
4. Proofroll completed subgrade when within 0.1 feet of final subgrade elevation.

D. GENERAL AREA FILL
1. Load, haul, place, grade, and compact all necessary general area fill in general grading area, covering banks, hollows, drain ditches, etc.
2. Place fill material in 6 to 8 inch loose lifts, compacted to a minimum of **90%** of Standard Proctor (ASTM D 698) and within +- 3% of optimum moisture. Except that in landscaping, planting bed areas, and infiltration areas unless otherwise specified or shown, compact the upper 12 inches of soil to 75 to 80% of standard proctor.

3.12 STRUCTURAL FILL SETTLEMENT MONITORING

A. Perform settlement monitoring in areas supporting buildings and/or retaining walls where foundations are supported on structural fill depths exceeds 10 feet.

B. Perform settlement monitoring using surface settlement markers installed no less than 50’ on center and in no case, less than 4 marker per fill area. Utilize a Surveyor registered in the State of Georgia to establish elevations at each marker 3 times per week until the Design Professional determines that building and/or retaining wall construction may.

C. Unless otherwise shown or approved, markers for soil installation consist of a 24” long, ½” diameter steel rod set in a 12” square by 4” deep concrete collar and assigned a unique reference number.

D. Remove all settlement markers at the conclusion of the monitoring period.

3.13 TESTING

A. All failing tests or retests are the responsibility of the Contractor.

B. Minimal testing requirements for Owners Quality Assurance are summarized below. Contractor may elect to collect additional samples and perform additional tests or prepare additional specimens for testing at its sole discretion in accordance with their own quality control program.
   1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Verify soil bearing capacity assumptions. Provide recommendations to the Design Professional regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Design Professional extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
   2. Provide characterization and classification, testing of all general fill, and subgrade materials as follows:
      a. Classification: 1 per material type/source
      b. Atterberg Limits: 1 per material type/source
      c. Grain size distribution
      d. Moisture – Density (ASTM D698 Standard Proctor for fine grained material, ASTM D1557Modified for coarse grained): 1 per material type/Source (except structural fill).
   3. Characterization and classification of import structural, import pavement area fill, and import trench backfill shall be sampled and tested at their designated sources a rate of 1 test per 250 CY of import if total quantity is greater than 1000 CY. If less than 1000 CY, sample and test a rate of 1 test per 100 CY. Perform field density and moisture tests (ASTM D6938, GDT 21 ,59). Other test methods based on material type may be proposed and are subject to approval by the Design Professional. Perform and report field density tests at the minimum frequencies listed below.
      a. Building Slab: 1 test for each type of soil type on excavated surfaces. 1 test per compacted fill layer each 2500 sq.ft. of area.
      b. Footings- Foundation: 1 test for each layer or type of soil present. In compacted fill layers, perform one test per 100 feet of footing length.
      c. Paving Area Fill: 1 test per per layer for every 2 feet of fill each 5,000 sq.ft. of area.
      d. General Area Fill: 1 test per every 2 feet of fill for each 10,000 sq.ft. of area.
      e. Utility trench, spread footing or retaining wall: 1 test per 2 feet of fill per 50 linear feet of trench.
   4. For import and export of materials, submit bills of lading or equivalent documentation to the Design Professional on a daily basis.

3.14 MAINTENANCE AND PROTECTION

A. Maintain subgrade, in condition and at compaction levels required, until improvements (site and/or building) are completed.
   1. Should subgrade or fill materials be disturbed or become water saturated, restore to the specified criteria as verified by the Design Professional.

B. Provide additional fill material, remove excess material, or redistribute material, should grades be changed from erosion or construction activities.

3.15 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 01
EXCAVATING, BACKFILLING, AND COMPACTING FOR STRUCTURES

PART 1 - GENERAL

1.01 Section Includes

A. Section includes the excavation, backfilling and compacting required for the structures shown in the Contract Drawings.

1.02 RELATED SECTIONS

B. Section 01 33 30 – Structural Submittals.

C. Section 01 45 25 – Structural Testing/Inspection Agency Services.

1.03 REFERENCES

D. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

E. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
****** OR **** **** OR **** **** OR ******
ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).

F. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

G. ASTM D1586 – Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

H. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 DEFINITIONS

J. Granular subbase: Granular fill directly beneath slabs-on-grade.

K. Backfill: Fill immediately behind foundation elements or retaining walls.

L. Structural fill: Fill under the structure other than the granular subbase.

1.05 SUBMITTALS

M. Upon request, submit soil test reports performed by the Structural Testing/Inspection Agency.

1.06 QUALITY ASSURANCE

N. Structural Testing/Inspection Agency shall perform the following quality related items:

1. Verify structural fill complies with specifications.
2. Determine particle size, liquid limit, plastic limit, plasticity index and maximum density of each type of soil.
3. Observe proofrolling.
4. Perform a sufficient number of field density tests to verify compaction of structural fill. As a minimum, perform one test per lift for every 2500 square feet of fill placed.
5. Verify foundation bearing capacity.
6. Verify quantities of material removed and quantities of material placed where Unit Prices are involved.

1.07 SURVEY

O. Prior to construction, have structure location staked and certified by a licensed surveyor. If discrepancies between actual lines and elevations exist, notify Design Professional before proceeding with layout of structure.

1.08 SUBSURFACE CONDITIONS

P. Copies of a subsurface investigation of the site will be made available upon request. The data is not intended as a representation or warranty of the continuity of such conditions. Owner will not be responsible for interpretation or conclusions drawn therefrom by the Contractor. The data is made available for the convenience of the Contractor and is not guaranteed to represent all conditions that may be encountered.

Q. Contractor may examine the site and make his own subsurface explorations at no additional cost to the Owner. Notify Owner prior to making any subsurface explorations.

1.09 EXISTING UTILITIES

R. Locate existing underground utilities by careful hand excavation. If utilities are to remain in place, provide protection from damage during construction operations.

S. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Do not interrupt existing utility service facilities occupied and used by Owner or others, unless written permission is given by the Design Professional and then only after temporary utility services have been provided.

T. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Design Professional immediately for directions.

U. Repair damaged utilities to satisfaction of utility owner.

1.10 NOTICE

V. Notify the Design Professional 48 hours prior to the beginning of any excavation work.

PART 2 - PRODUCTS

2.01 GRANULAR SUBBASE

A. Granular subbase shall be sound and free-draining, such as sand, gravel or crushed stone with less than 10% passing the 200 sieve. Maximum diameter shall be 1-1/2 inches.

2.02 BACKFILL

A. Backfill shall meet the requirements of the granular subbase.

2.03 STRUCTURAL FILL

A. Structural fill shall meet the requirements of backfill specified above.
****** OR **** **** OR **** **** OR ******
Structural fill shall consist of clayey sand, sand, or sandy clay with a plasticity index less than 7.
****** OR **** **** OR **** **** OR ******
Structural fill shall consist of granular material. Granular material shall consist of either sand or gravel or a combination of both. Fill material shall be clean, reasonably well graded, non-plastic (zero PI) with less than 15% passing the 200 sieve and less than 30% passing the 100 sieve. No clayey material or dirt will be allowed.
****** OR **** **** OR **** **** OR ******
Structural fill shall be silty sand, clay, silty clay, or sandy clay with a plasticity index of less than X.
****** OR FOR SHOT ROCK FILL **** **** OR FOR SHOT ROCK FILL ******
Structural fill shall be reasonably well graded shot rock from on-site excavations or from outside sources with a maximum rock size of 12 inches and less than 20 percent passing a NO. 4 sieve.

B. Structural fill shall be free of organics, debris and deleterious materials.

PART 3 - EXECUTION

3.01 STRIPPING

A. Strip vegetation, topsoil, roots, and other unsuitable material to a depth determined by the Structural Testing/Inspection Agency but not less than one foot, nor less than 10 feet outside the perimeter of the structure.

B. Stockpile sufficient amounts of topsoil as required to cover areas to be landscaped with a minimum of six inches of material.

3.02 EXCAVATION

A. Excavation shall be considered unclassified.

B. Perform excavation to the depths and limits on the Drawings and as specified herein.

C. Do not excavate to full depth when there is probability of frost forming or ground freezing in excavation before concrete is placed.

D. Ground water may be encountered during the foundation excavation. Provide a system for controlling the ground water to a level at least three feet below the lowest point of the excavation.

E. Keep excavations dry by sloping ground away from holes and trenches.

3.03 PROOFROLLING

A. After stripping or excavation and before any fill placement, fill areas shall be proofrolled with a minimum of two coverages of a loaded dump truck or scraper in each of two perpendicular directions.

B. Areas found to be soft or pumping shall have the soft soil removed and replaced with structural fill and compacted as outlined herein.

3.04 PLACEMENT OF STRUCTURAL FILL

A. Do not place structural fill on subgrade that contains frost, mud or is frozen.

B. Structural fill shall be placed and compacted in X-inch thick loose layers.

C. Compact structural fill to 98 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +XX/-XX percent of the optimum moisture content.
****** OR **** **** OR **** **** OR ******
Compact structural fill to 95 percent of the maximum dry density as measured by Modified Proctor, ASTM D1557, with water content within +XX/-XX percent of the optimum moisture content.
****** OR FOR SHOT ROCK FILL **** **** OR FOR SHOT ROCK FILL ******
Compact shot rock fill in 12-inch layers using six complete passes of 5-ton class vibratory roller, or 8 passes of a D-8 class crawler tractor. A pass is defined as a complete coverage of the surface with roller drum overlapping 2 feet, or D-8 track overlapping 50 percent. No water content control will be required.

3.05 PLACEMENT OF GRANULAR SUBBASE

A. Do not place granular subbase on subgrade that contains frost, mud or is frozen.

B. Compact granular subbase to 95 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with the water content within +XX/-XX percent of the optimum moisture content.
****** OR **** **** OR **** **** OR ******
Compact granular subbase to 90 percent of the maximum dry density as measured by Modified Proctor, ASTM D1557, with water content within +XX/-XX percent of the optimum moisture content.

3.06 PLACEMENT OF BACKFILL

A. Backfill behind wall shall be placed in layers of six inches.

B. Compact backfill behind walls to 95 percent of the maximum dry density as measured by Standard Proctor, ASTM D698, with water content within +XX/-XX percent of the optimum moisture content.
****** OR **** **** OR **** **** OR ******
Compact backfill behind walls to 90 percent of the maximum dry density as measured by Modified Proctor, ASTM D1557, with the water content within +XX/-XX percent of the optimum moisture content.

3.07 CLEAN UP

A. Remove excess excavated materials from job site and upon completion leave site in clean condition.

END OF SECTION

SECTION 31 25 00
EROSION & SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Compliance with NPDES Phase II Construction General Permit No. GAR 100001 for land disturbing activities over 1 acre in extent.
   2. Temporary erosion, sedimentation, and pollution controls (air, water, soil) from site preparation through final site stabilization that include, but are not limited to:
      a. Silt dams, traps, barriers and
      b. Slope stabilization,
      c. Temporary grading to manage stormwater and dewatering activities.
      d. Polyacrylamide (PAM) applications.

B. Related Sections:
   1. 31 00 01 “SITE PREPARATION AND GENERAL SITE WORK” for protection of existing vegetation, waste management, and spill prevention.
   2. 31 22 00 “EARTHWORK” for dewatering requirements and additional requirements for Temporary Grading and Drainage.
   3. 32 92 00 “TURF & GRASSES” for temporary vegetation and mulching and for permanent grassing.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. The Manual for Erosion and Sediment Control in Georgia, 2016 Edition, by the Georgia Soil and Water Conservation Commission, “Best Management Practices”. Apply to all land disturbing activities.

B. The State of Georgia Department of Natural Resources Environmental Protection Division “National Pollution Discharge Elimination System” General Permit No. GAR 100001. This permit applies to all land disturbing activities for this project.

1.03 SUBMITTALS

A. Schedule of operations: Submit schedule of proposed operations conforming with the “Land Disturbance Activities Sequence” as delineated on the Erosion, Sedimentation & Pollution Control Plan(s), including program for erosion control measures, logs, documentation, identified superintendent with required continuing education certification, maintenance of control facilities and vegetative practices. Show anticipated starting and completion dates for land-disturbing activities including excavation, filling and rough grading, finished grading, construction of temporary and permanent control measures, and disposition of temporary sediment control measures.

B. Product Data: For each type of the following manufactured products required provide manufactures data to the Owner for review and comment prior to bringing products onsite and incorporating into the work. Product submittals include, but are not limited to:
   1. Silt fence.
   2. Rolled erosion control blankets.
   3. Anionic polyacrylamide (PAM).

C. Samples: Submit samples of the following items or products prior to incorporating into the work.
   1. All Class A and Class B Erosion Control Blanket products proposed for the work.
   2. PAM gel bars or logs.

1.04 QUALITY ASSURANCE

A. Comply with "Manual for Erosion and Sediment Control in Georgia" and “Best Management Practices” for practices, procedures, and operations.

B. Obtain NPDES Phase II permit coverage and conform to all provisions under the State of Georgia and Federal Clean Water Act (permit no. GAR 100001). Refer to

http://epd.georgia.gov/npdes-construction-storm-water-general-permits. Responsibilities of the Contractor include, but are not limited to:

1. Filing a NOI (Notice of Intent) with State's Environmental Protection Division (EPD) 72 hours prior to land disturbance activities with both the Owner's signature and the General Contractor's signature.
2. Maintain a log book log book on site documenting the inspections of erosion control devices (minimum once/week and within 24 hrs of any storm event) and noting any corrections or modifications. Document all rainfall events. As necessary, coordinate and assist with required stormwater monitoring requirement and maintain monitoring reports prepared by the Testing Agency (with the log book).
3. Filing a NOT (Notice of Termination) with the EPD when the site is fully stabilized and all stormwater discharge associated with the construction activity has ceased.

C. Erosion, Sediment and Pollution Control Superintendent:
   1. Provide a designated representative to remain on site during land disturbance activities with the following qualifications:
      a. Minimum 5 years of experience in erosion, sediment and pollution control.
      b. Certification Level 1A (minimum) "blue card" from Georgia Soil & Water Conservation Commission.
   2. Duties include:
      a. Oversight of land disturbance operations.
      b. Ensure strict adherence to the land disturbance construction activities sequence, strict adherence to all "Best Management Practices" as defined in the "Manual for Erosion and Sediment Control in Georgia"
      c. Monitor proper grading (terracing, berming, etc..) to properly divert water, and maximize storm water travel lengths and minimize path slopes.
      d. Monitor and provide for temporary or permanent site stabilization as soon as possible and within the required time limits.

1.05 SITE CONDITIONS

A. Furnish and install erosion control measures prior to or concurrent with any land disturbance activity. Conform with the "Land Disturbance Activities Sequence" (if applicable).

B. The Contractor is solely responsible for ensuring that no silt or debris leaves the immediate construction site. Return any silted or eroded area to its natural state.

C. Install and maintain erosion and sediment control "Best Management Practices" prior to land disturbing activities, and continuously through construction until final site stabilization measures (paving, planting, etc.) are effective at controlling erosion from the site.

D. Schedule grading operations to allow permanent erosion control to take place in the same construction season. Avoid or minimize exposure of soils to winter weather. Maintain all controls until vegetative cover has been established.

E. The Contractor is responsible for all quantities of soil erosion control measures regardless if shown on the drawings. The extent of soil erosion control measures shown on the drawings is considered minimum. Install additional erosion and sedimentation control measures when deemed necessary by the Contractor, or on-site inspections from the Owner, Design Professional, Testing Agency or by authorities having jurisdiction.

1.06 PROTECTION OF ADJACENT PROPERTY AND STATE WATER BUFFERS

A. Protection existing State Water Buffers and adjacent property from sediment trespass is of the essence. Flag and fence buffers, tree save areas and property lines prior to any construction activities. Flag stream (State Water) buffers as shown on the approved "Erosion, Sedimentation, and Pollution Control Plan". Unless otherwise shown, install 11"x17" weatherproof signs along State Water buffer(s) at 40 ft intervals, that read:

"STATE WATER BUFFER – DO NOT DISTURB"

B. Protect adjacent property including, but not limited to: landscape areas, stormwater facilities, sidewalks, curbing, roadways and all utilities therein.

PART 2 - PRODUCTS

2.01 TEMPORARY GRASSING MATERIALS

A. Use quick growing temporary grass species suitable to the area and season.

B. Refer to 32 05 00 "Common Works for Exterior Improvements" for soil additives and mulches, refer to 32 92 00 "Turf Grasses" for temporary seed mixes.

2.02 HYDRAULICALLY APPLIED MULCH

A. Wood cellulose fiber containing no germination inhibiting or growth inhibiting agents with characteristics (including acceptance tolerances) as follows:
   1. Percent moisture content: 9.0% (+ 3, 0%).
   2. Percent organic matter: 99.2% (+ 0.8%).
   3. Percent ash content: 0.8% (+ 0.2%).
   4. pH: 4.8 (+ 0.5).
   5. Min. water holding capacity: 150 grams water / 100 grams fiber.

2.03 BONDED FIBER MATRIX MULCH

A. Bonded Fiber matrix (BFM) manufactured to be hydraulically applied, and upon drying, adheres to the soil in the form of a continuous, 100% coverage, biodegradable, erosion control blanket. Acceptable BFM producers include:
   1. Soil Guard as manufactured by Mat, Inc., phone (888) 477-3028
   2. Ecoaegis as manufactured by Canfor Panel & Fibre Market, LTD, phone (800) 363-8873
   3. Conwed 3000 Profile Products, phone (800) 508-8681

B. The BFM shall be comprised of a long strand, thermally produced wood fibers passing a freeness test at a 760 cc (MLS) level or below (>88% of total volume by weight) held together by organic tackifiers (10%) and mineral bonding agents (>2%) which upon drying become insoluble and non-dispersible.

C. The matrix which forms shall be designed, tested and proven to perform in a manner equal or superior to biodegradable erosion control blankets (ECB's). Documentation of testing at an independent university laboratory shall be provided which demonstrates superior performance as measured by reduced water runoff, reduced soil loss, and faster plant germination, as compared to ECB's. The formed matrix shall meet the following requirements:
   1. Pass a free liquid quality control test (liquids separate from fibrous solids no greater than one inch in one minute's time as measured on a standard test board).
   2. Does not dissolve or disperse upon rewetting.
   3. Does not have holes > 1mm in size and no gaps between product and the soil.

2.04 SILT FENCE (TYPE C)

A. Geotextile: Silt fence fabric shall be woven geotextile for Type C fabric. Type A fabric may be either woven or non-woven. Fabric shall conform with the following properties:

Property *	**Type C Fabric**	**Type A Fabric**
Min. Tensile Strength (lbs) *(ASTM D-4632)*	Warp – 260 Fill – 180	Warp – 120 Fill – 100
Elongation (% Max.) *(ASTM D-4632)*	40	40
AOS (Apparent Opening Size) *(ASTM D-4751)*	No. 30	No. 30
Flow Rate (Gal./Min./Sq.Ft.) *(GDT-87)*	70	25

Ultraviolet Stability *(ASTM D-4632 after 300 hours weathering in accordance with ASTM D-4355)*	80	80
Bursting Strength (PSI Min.) *(ASTM D-3786)*	175	175
Minimum Fabric With (Inches)	36	36

* from GDOT Standard Specification 881.2.07

B. Wood posts:
   1. Minimum dimension: 1 ½ inch by 1 ½ inch by 4 feet.
   2. Untreated fir, redwood, cedar, or pine cut from sound timber with no loose or unsound knots.

C. Steel posts:
   1. 48 inch minimum length.
   2. Cross section shape that can resist failure from lateral loads (T-shaped, U-shaped, or L-shaped) and 0.75 pounds per foot minimum mass.

D. Silt fence reinforcement (if used):
   1. Wire mesh consisting of 14 gauge steel with mesh spacing of 6 inch x 6 inches (maximum), or prefabricated polymeric mesh of equivalent strength.

2.05 RIPRAP

A. Unless otherwise specified, riprap is well graded GDOT Type 3 (Standard Specification 805). Stone shall be made of sound, durable naturally occurring rock with nor more than 5% by weight being weathered or decomposed material or shales. Type 3 riprap gradation is as follows.

Volume	**Approx. Weight**	**Percent Smaller Than**
1.0 cu-ft	165 lbs	100%
0.1 cu-ft	15 lbs	10-65%
2” square sieve	-	Maximum 15%

2.06 FILTER STONE & SURGE STONE

A. Unless otherwise shown Filter stone, surge stone is in accordance with Appendix C of the Manual for Erosion and Sediment Control in Georgia.

2.07 SLOPE STABILIZATION BLANKET

A. Class A Blanket:
   1. Application: Unless otherwise shown on the Plans, apply on slopes steeper than 3H:1V, up to a maximum of 1H:1V.
   2. Double net blanket.
   3. Rated for extended survivability with at least a 12 month functional longevity.
   4. Biodegradable natural fiber netting for blanket for slopes up to 2H:1V.
   5. Slow degrading polypropelyne or other manufacturer tested /rated netting for slopes steeper than 2H:1V.
   6. Core: Straw and Coir (Coconut) blend fiber or Excelsior (shredded aspen) fiber. Certified weed free straw. Alternative core products may be submitted for approval.
   7. Approved Products and Manufacturers:
      a. "Curlex ® II Blanket" by American Excelsior Company.
      b. "SK Straw/Coir Blanket” by Bon Terra. Note- Netting option shall be consistent with the slope application.
      c. "Ero-Mat Excelsior" by Verdyol.

B. Class B Blanket:
   1. Application: Unless otherwise shown on the Plans, apply on slopes of 3H:1V or flatter.
   2. Single net blanket.
   3. Net shall be either biodegradable (natural fiber) or photodegradable synthetic mesh.
   4. Rated for short term survivability with up to a 12 month functional longevity.
   5. Straw core material, if used, shall be certified weed free.
   6. Approved Products and Manufacturers:
      a. "Curlex ® I Blanket" by American Excelsior Company.
      b. "S Straw Blanket" with jute/cotton threading by Bon Terra.
      c. "EroNET TM S75" by North America Green.

2.08 NON-WOVEN GEOTEXTILE FABRIC

A. Non-woven geotextile fabric shall be as indicated on Plans. If not otherwise indicated, fabric weight is a minimum or 4 oz. per square yard.

2.09 POLYACRYLAMIDE

A. All polyacrylamide shall be anionic and in emulsion form and gel bars/logs.

PART 3 - EXECUTION

3.01 GENERAL

A. Sedimentation Control: Sediment basins, diversion berms, silt dams, traps, barriers, downlines, check dams, rock filter dams, seep berms, mulching temporary grassing and appurtenances shall be installed and shall be maintained in-place for duration of construction, as shown and detailed on erosion control plan.

B. Silt fence:
   1. Construct silt fences as shown in the Plans.
   2. Where shown install multiple rows of silt fence.

C. Provide and construct erosion control check dams as shown.

D. Maintain erosion and sedimentation controls in a condition which will retain unfiltered water.

E. Construct sedimentation ponds and control devices prior to clearing and grubbing the site to insure complete silt control.

F. Provide temporary seeding for all exposed soil surfaces that are not to be fine graded or landscaped within 14 calendar days. Multiple temporary seeding applications should be expected.

G. Provide temporary or permanent grassing (season dependent) and\or mulching for all disturbed areas within 7 calendar days of reaching finished grades. Reduce areas of disturbance daily through use of temporary grassing and mulching.

3.02 GRADING OPERATIONS

A. Grading Operations: Phased grading operations so that the ground surface will be disturbed for the shortest possible time before permanent construction is installed. Maintained large areas as flat as possible to minimize soil transport through surface flow. Immediately install graded diversion channels, ditches and berms to direct storm runoff to sediment and filtering basins. Grade fill slopes in a manner which prevents surface areas from flowing over newly constructed fill slope areas through shaping and providing required temporary downlines or diversions to permanent storm structures as construction allows.
   1. Protect newly graded areas from actions of the elements. Repair settlement or washing that occurs prior to acceptance of work and maintain established grades until the date of substantial completion.
   2. Contractor is responsible for any damage occurring to adjacent property resulting from drainage or siltation from the site.
   3. Construct all fills at outmost part of fill and slope towards original ground so that all surface storm water drains back away from fill and does not run over the top of fill slope. Construct swales at bottom of proposed fill slopes prior to construction of any fills.

Construct and maintain a swale /berm at the outermost part of top fills as fills are constructed.

B. Storm Drainage System: Install as much of the permanent storm drainage system as practical, provide the required temporary inlet sediment traps immediately and divert surface water into the system. Install temporary inlet sediment traps shall as base of structure is set and adjust up periodically as the grading operation raises the grades around the structure.
   1. Maintain temporary sediment barriers at drainage structures until final stabilization occurs.
   2. Install storm drainage as grading progresses and makes additional storm drainage installation possible. Direct swales to drainage structure locations as shown on drawings.

C. Ground Cover:
   1. All exposed and unworked soil shall be protected by application of temporary groundcover.
   2. Ground cover may consist of any effective erosion preventative treatment such as straw or other mulches, planting, etc.
   3. All grassing or planting operations shall include mulching as stabilization until ground cover by planting is effective.

3.03 STABILIZATION PRACTICES

A. Control soil erosion during all phases of construction to preserve and protect slopes, drainage structures, pavement, and other facilities, and to reduce potential sources of water pollution and damage to adjacent property.

B. Mulching: Apply dry straw or hay and/or wood chip mulch to disturbed areas at a depth of two to three inches unless otherwise shown. Apply by hand or mechanical equipment. Press Straw or hay mulch shall be pressed into the soil with a disk harrow with disk set straight or with special “Packer Disk”. The edge of the disk should be dull enough not to cut the mulch but to press it into the soil leaving much of it in an erect position. Anchor immediately after application.

C. Polyacrylamide (PAM): Utilize anionic polyacrylamide as a temporary soil binding agent to reduce soil erosion. PAM is available in emulsions, powders and gel bars or logs. Use PAM in conjunction with other “best management practices”. Use PAM in direct soil surface applications where the timely establishment of vegetation is not feasible (including building pad and parking lot areas). Apply PAM in conjunction with temporary seeding efforts or as a separate hydro spray application. The maximum application of PAM, in pure form, shall not exceed 200 pounds/acre/year. Install a PAM gel bar or log in each storm structure (secured with rope) and replace at the manufactures recommended interval. Apply PAM via hydro spreader to all disturbed areas once per 14 calendar days at the rate of 7.5 pounds per acre. Provide written record of each application.

D. Temporary Stabilization: Stabilize topsoil stockpiles and disturbed areas of the site, where construction activity has ceased for at least 14 calendar days with temporary cover or seeding.

E. Seed Bed Preparation for Temporary Vegetation: Loosen ground surface by discing, raking or harrowing. If the area has been recently loosened or disturbed, no further roughening shall be required. Remove all large clods, boulders and debris that will interfere with the work.

F. Unless otherwise shown, plant temporary grass areas at the rates specified in 32 92 00 Turf and Grasses.

G. Hydroseeding: Protect existing trees and shrubs during hydroseeding. Apply seed, fertilizer, lime, and fiber in one application. Maintain temporary vegetative cover until the permanent turf planting season, at which time the temporary grass or annual ryegrass shall be mowed down to the ground surface, the lawn area disc harrowed, the soil prepared for planting lawns and the permanent lawn planted or sodded as called for on the plans. Refer to 32 92 00 “Turf and Grasses” for permanent turf.

H. Reseeding – Reseed and provide straw cover for bare areas 1 square foot and larger to establish and maintain vegetative cover and to prevent sheet and rill erosion. Repair erosion damage as required and reseed.

I. Matting and Mulching – Cover all seeding with matting or mulch. After seeding, cover all slopes that exceed 3H:1V with erosion control matting and/or blankets. Install mats and/or blankets per manufacturer's recommendations using the recommended fastening hardware.

J. Depending on the season at which slopes that exceed 3H:1V are established, the Contractor shall anticipate multiple applications of erosion matting. If a permanent slope is established and planted with temporary grass due to planting season, contractor shall eradicate temporary grass and install permanent grassing as called shown. Once bare soil is exposed, an additional application of matting will be required. Remaining seeded areas shall be covered with straw or hay spread at the rate of approximately 2 tons/acre or wood cellulose fiber applied at the rate of approximately 1500 lbs/acre.

K. Stabilize areas of the site that are to be paved through proper compaction of the soil and placement of a graded, stone aggregate base.

L. Rolling – Roll all seeded areas with roller weighing 60 to 90 pounds per linear foot of roller before applying mulch. On steep slopes cover seeds by dragging spiked chains or similar methods.

M. Watering – Depending on weather conditions at the time of construction, Contractor shall anticipate watering measures other than natural rainfall. Provide all watering necessary to establish a healthy vegetative cover.

N. Permanent Stabilization – Stabilize disturbed areas of the site where finished grade has been with season dependent permanent seeding within 14 calendar days of achieving grade. Refer to Plans and 32 92 00 "Turf and Grasses" for permanent seed mixes.
   1. Hydroseed mixtures shall contain PAM.
   2. After seeding provide erosion control mattering or blankets where shown and in accordance with manufacturers recommendations.

O. Complete all permanent erosion control features at the earliest practical time. Use temporary measures until permanent measures are completed.

3.04 STRUCTURAL PRACTICES

A. Submit any additional structural control measures in the form of shop drawings.

B. Temporary Construction Entrance – Construct a stabilized, stone aggregate construction entrance shall be constructed, as per the detail set forth in the Manual for Erosion and Sediment Control in Georgia, Latest Edition. The temporary construction entrance shall reduce vehicle tracking of sediments. Out-going trucks shall have the tires washed prior to exiting the site onto any public street or right-of-way. Any mud, dirt, or rock that is tracked onto public streets shall be swept immediately and material placed within the perimeter controls.

C. Maintain all access to the site to prevent mud from washing or being tracked onto existing pavements. Provide a temporary hose bib system or water truck with a pressure hose for wash down of trucks and equipment entering the public right-of-way as necessary.

D. Sediment Basins – Construct temporary sediment basins to contain and filter at least 67 cubic yards of sediment per disturbed acre and in accordance with the Manual for Erosion and Sediment Control in Georgia, 2016 Edition. Construct the unit complete as shown including:
   1. Principal spillways with riprap outfall protection.
   2. Anti-seep collars.
   3. Risers and Trash racks.
   4. Temporary mulching and grassing of external slopes.
   5. Skimmers.
   6. Emergency overflow areas.

E. Silt Barriers – Unless shown otherwise, install a single row of Type "C" Silt fence along the toe of all downstream slopes and a double row of Type "C" Silt Fence adjacent to all state waters buffers.

F. Temporary Diversion Berms/Dikes – Construct temporary diversion berms/dikes per the approved Erosion, Sedimentation, and Pollution Control Plan. Raise diversions, minimum 4

feet wide, at the end of each day during grading activities. The diversions shall intercept and redirect runoff to the temporary sediment basin(s) and/or temporary storm drainage structure sediment inlet traps prior to the runoff reaching perimeter sediment controls.

3.05 MAINTENANCE

A. Inspect slope protection and erosion control elements after each rainfall. Unless otherwise shown, inspect all barriers and sediment traps after each rain event. Clear all debris and accumulated sediment from behind barriers and sediment traps when one third full. Remove accumulated sediment from traps after each rain event and spread on site.

B. Provide appropriate stabilization (mulch, grass seed) where collected sediment is redistributed onsite.

C. Control dust from disturbed areas by means of mulching, watering, calcium chloride or other method subject to the Design Professionals approval.

3.06 REMOVAL OF TEMPORARY EROSION CONTROL DEVICES

A. As soon as permanent vegetative cover is established, remove temporary devices, including sediment barriers, berms, silt traps and similar devices.

B. Remove any retrofit structure and clean out all accumulated silt and debris in detention ponds to finish grades.

C. Remove all debris resulting from temporary erosion control from project site.

END OF SECTION

SECTION 32 05 00
COMMON WORKS FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.02 SUMMARY

A. Section Includes :
1. Furnished Topsoil.
2. Water
3. Soil Amendments.
4. Mulch.
5. Compost
6. Graded Aggregate Base (GAB).
7. Coarse Sand
8. Coarse Aggregates.
9. Drain Rock.
10. Controlled Low Strength Flowable Fill (Flowable Fill)
11. Geotextiles.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Georgia Department of Transportation (GDOT)
1. Department of Transportation, State of Georgia Standard Specifications, Construction of Roads and Bridges, 2013 Edition. Unless otherwise noted, conform with GDOT Standard Specifications for materials.

B. American Society for Testing Materials (ASTM)
1. ASTM D1557- laboratory compaction characteristics of soil using Modified Effort.

1.03 SUBMITTALS

A. Product data for all material proposed for the work, including but not limited to:
1. Compost
2. Nutrient grade compost.
3. Aggregate gradations and test reports.
4. Flowable fill mix designs.

B. Copies of all soil testing results for lawn and landscape planting areas, including but not limited to the following data:
1. Include the recommended ratio and amounts (lbs per 1000 sq-ft) of fertilizing.
2. Amendments of lime, organic matter.

C. Field and laboratory test or quality control results including, but not limited to, the following:
1. Aggregate gradation, proctor, compaction, moisture, depth.

1.04 SITE CONDITIONS

A. Store materials only in areas designated for Contractor's use.

PART 2 - PRODUCTS

2.01 FURNISHED (IMPORT) TOPSOIL

A. Furnished Topsoil is adapted to the sustenance of plant life and harvested from fields or development sites. Manufactured topsoil where components such as sand, organic matter, and chemicals are added to mineral soil are not acceptable. Furnished topsoil shall reasonably achieve the following characteristics:
1. Texture – USDA loam, sandy clay loam, or sandy loam with clay between 15 and 25% and combined clay and silt content no more than 55%.
2. Organic Material – 2.0 to 20% by mass
3. pH - between 5 and 7.
4. Uniform quality and free from foreign material such as hard clods, sod, stiff clay, hard pan, stones larger than 1 inch diameter, lime cement, ashes, slag, concrete, tar residues, tarred

paper, boards, chips, sticks, or other undesirable materials. It shall also be reasonably free from weeds and objectionable plant material.

B. All sources of Furnished (Import) Topsoil shall be approved by the Design Professional prior to delivery to site. Test proposed topsoil and submit test results for approval, along with a minimum 1 gallon labeled soil sample.

C. Stockpiled existing topsoil at the site meeting the above criteria may be acceptable.

D. Furnished Topsoil shall be screened.

2.02 WATER

A. Furnish water used in this work. Furnish watering trucks, hoses and other temporary watering equipment (sprinklers, stands. etc.) required for work.

B. When used for plant irrigation, water shall be suitable and free from ingredients harmful to plant life.

2.03 SOIL APPURTENANCES (AMMENDMENTS)

A. Mulches and Composts: See separate Articles this specification.

B. Ground Limestone: Lime shall be ground limestone (Dolomite) containing not less than 85 percent of total carbonates and ground to such a fineness that 50 percent will pass through a 200-mesh sieve and 90 percent will pass through a 20-mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing through the 100-mesh sieve.

C. Sand: Clean, washed sand, free of toxic materials.

D. Sawdust: Rotted sawdust, free of chips, stones, sticks, soil or toxic substances and with 7.5 lbs nitrogen fertilizer uniformly mixed into each cubic yard of sawdust.

E. Peat Moss: granulated sphagnum free of woody substances, brown in color, free of stones and mineral matter, air dry condition.

F. Peat Humus: When shown provide a domestic product of peat humus consisting of partially decomposed vegetable matter of natural occurrence. It shall be brown, clean, low in content of mineral and woody material, mildly acid, and granulated or shredded.

G. Commercial Fertilizer: Fertilizer formula complying with State and Federal fertilizer laws. Deliver fertilizer to the site in original, unopened containers bearing the manufacturer's certificate of compliance covering analysis and primary nutrient (N, P, K) concentrations. To protect public health and waterways, do not over apply any fertilizer. Unless otherwise shown on the plans or specified in other Sections, fertilizer application is as follows:

1. Lawns: Provide nutrients in ratios and quantities (lbs per 1000 sq-ft, or lbs per acre) as recommended from soil testing. Provide nitrogen in a form that will be available to lawn during initial growth period (approximately 50% fast release) as well as in slow release organic forms (approximately 50%).
2. Trees and shrubs (planting beds): Provide in the ratios and quantities (lbs per 1000 sq-ft, or lbs per cubic yard of soil) in accordance with results of soil tests.

H. Ammonium Nitrate: Use where specified or where a fast release nitrogen fertilizer is required. Commercial product in dry granular form of recent manufacture (within last 6 months) and delivered in the original, unopened containers each bearing the manufacturer's guaranteed statement of analysis, containing not less than 33.0% percent Nitrogen.

I. Pre-emergent Weed Control: shall be Scotts Pro Grow Ornamental Herbicide 2 (granular) and Pro Turf Southern Weed Grass Control #83204 (or approved equal) as manufactured by Scotts Pro Grow, Marysville, Ohio 43041.

2.04 MULCHES FOR GRASSING AND EROSION

A. Provide mulches of the types and depths shown, that are clean and free from debris, and reasonably free of weeds. Mulches may include, but are not limited to:

1. Bermuda grass hay.

2. Threshed wheat rye or oat straw.

2.05 COMPOST

A. Use compost that meets the following:
1. Composed of decomposed organic material.
2. Organic material is disinfected through composting (minimum 9 months) or similar technologies.
3. Stabilized so it is beneficial to plant growth.
4. Mature, dark brown or black in color and have an earthy odor.
5. Contain no human pathogens.
6. pH range of 5 to 8.
7. Contains not more than 25% by volume wood shavings, sawdust or refuse.

B. Submit all ingredient in the compost mix, and their relative proportions.

2.06 NUTRIENT GRADE COMPOST

A. Provide nutrient grade compost manufactured from a composter enrolled in the Untied State Compost Council Seal of Testing Assurance (STA) Program. [When shown provide ERTH Food™ as distributed by: Exceptional Products, Inc, 402 Line Creek Dr., Peachtree City, GA 30269, or approved Equal that meets the following parameters as tested by an STA approved lab:

Plant Nutrient	% dry weight basis	TMECC Method
Nitrogen	>1.2	4.02D
Phosphorus	>.50	Calc.
Potassium	>.50	Calc.
Calcium	>.90	4.05
Magnesium	>.20	4.05
Organic Matter Content	>50%	5.07-A
Soluble Salts dS/m (mmhos/cm)	<4.0	4.08-A
Particle Size % under 9.5 mm	95% or greater	2.02-B
Stability Indicator (respirometry) C02 Evolution mg C02-C/g OM/day	<2	5.08-F777
Maturity Indicator (bioassay) Percent Emergence	85% or greater	5.05A
Select Pathogens (pass/fail per US EPA Class A standard, 40 CFR 8503.32 (a)) Method 9221E	Pass	Standard

2.07 GRADED AGGREGATE BASE (GAB)

A. GAB material shall be composed of well graded crushed stone consisting of hard, durable rock fragments free from clay and reasonably free from flat, elongated or soft pieces of organic matter.

B. GAB shall achieve the following gradation:

Sieve Size	Percent Passing by Weight
2 in	100
1-1/2 in	97-100

3/4 in	60-95
No. 10	25-50
No. 60	10-35
No. 200	7-15

2.08 COARSE SAND

Clean, washed, sand free of toxic materials free of limestone, shale and slate particles, complying with ASTM C-33 fine aggregate for concrete.

A. Coarse sand shall achieve the following gradation :

Sieve Size	Percent Passing by Weight
3/8 in	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10
No. 200	2-5

2.09 COARSE AGGREGATES

A. Gradation shall comply with the table below. Refer to TABLE 800.1 GDOT Standard Specifications for other sizes when referenced.

Size NO	Nominal Size Square Opening *	Amounts finer than each laboratory sieve (square openings) % by weight										
		2½”	2”	1½”	1”	¾”	½”	⅜”	No. 4	No. 8	No. 16	No. 50
3	2” - 1”	100	90-100	35-70	0-15	-	0-5	-	-	-	-	-
4	1½ - ¾”	100	95-100	-	35-70	-	10-30	-	0-5	-	-	-
5	1 – ½”	-	-	100	90-100	20-55	0-10	0-5	-	-	-	-
57	1” – No.4	-	-	100	95-100	-	25-60	-	0-10	0-5	-	-
6	¾ - ⅜”	-	-	-	100	90-100	20-55	0-15	0-5	-	-	-

2.10 CONTROLLED LOW STRENGTH FLOWABLE FILL

A. Flowable fill where required shall meet the requirements of GDOT Std. Spec Section 600.3.03 for Excavateable mix design. The mix design shall produce a consistency that will result in a flowable self-leveling, self-compacting product at time of placement.

Property or Content	Quantity

Cement Type 1	75-100 lbs / yd^3
Air	15-35%
28-Day Compressive Strength	Maximum 100 psi
Unit Weight	90-100 lbs / ft^3

2.11 GEOSYTHETICS

A. Separation fabric:

Woven polypropylene fabric, high modulus type with good separation capabilities conforming to the following:

Property	Test Method	Requirement
Grab Tensile Strength	ASTM D 4632	200 lbs min.
Grab Tensile Elongation	ASTM D 4632	30% max.
Mullen Burst Strength	ASTM D 3786	400 psi min.
Trapezoid Tear Strength	ASTM D 4533	75 lbs min.
Puncture Strength	ASTM D 3787	75 lbs min.
CBR Puncture	ASTM D 6241	
Apparent Opening Size (AOS)	ASTM D 4751-99a	20 to 50 US Sieve

PART 3 - EXECUTION

3.01 AGGREGATE BASES

A. Placement
1. Maximum single layer compacted course is 8 inches.
2. If total thickness of base exceeds 8 inches, construct in 2 or more courses of equal thickness.

B. Compaction
1. Ensure moisture content is uniformly distributed and sufficient to achieve optimum moisture.
2. Uniformly roll the base to line, grade, and section and to the required percentage of maximum dry density.
3. For multiple courses, add water as necessary to achieve optimum moisture content.
4. In areas inaccessible to roller, obtain the required compaction with mechanical tampers approved by the Testing Agency or Design Professional.

C. Maintenance
1. Maintain the base until it is sufficiently ready for paving courses. Repair defects by additional watering, rolling, and blading as necessary.

3.02 CONTROLLED LOW STRENGTH FLOWABLE FILL

A. Placement
1. When using as a backfill for pipe, where float or misalignment may occur, assure correct alignment of pipes by using straps, soil anchors, or other approved means of restraint.
2. Flowable fill may be placed in confined spaces containing standing water, unless subgrade preparation requirements are otherwise shown or specified.
3. Minimum temperature of flowable fill at the point of delivery is 50°F.
4. Minimum air temperature during placement is 35°F and rising.

B. Maintenance
1. Protect flowable fill from freezing for 36 hours after placement.

END OF SECTION

SECTION 32 13 01
RIGID PAVING AND SITE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Concrete curb and gutter.
   2. Concrete walkway, flumes, and other miscellaneous cast in place elements.
   3. ADA ramps.
   4. Concrete paving of driveways, roadways, dumpster pads, loading dock pads, and parking lots.

B. Related Sections:
   1. 31 22 00 “EARTHWORK” for backfill and compaction of trench excavations prior to paving and for general subgrade preparation.
   2. 32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS” for graded aggregate base (GAB) if shown on the Plans.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Georgia Department of Transportation (GDOT)
   1. Department of Transportation, State of Georgia Standard Specifications, Construction of Roads and Bridges, 2013 Edition. Unless otherwise noted, conform with GDOT Standard Specifications for testing, materials, and methods for bases and concrete pavements.
   2. GDOT Test Procedures (GDT), where referenced.

B. American Concrete Institute (ACI)
   1. ACI 301: Specifications for Structural Concrete.
   2. ACI 308.1: Standard Specification for Curing concrete
   3. ACI CP-1: Technical Workbook for ACI Certification of Concrete Field Testing Technician-Grade 1.

C. American Society for Testing Materials (ASTM)
   1. ASTM A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Placement
   2. ASTM A1064: Standard Specifications for Carbon Steel Wire and Welded Wire Reinforcement.
   3. ASTM C31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   4. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete.
   7. ASTM C309: Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
   8. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
   9. ASTM D994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   10. ASTM D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
   11. ASTM D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
   12. ASTM D3406: Standard Specification for Joint Sealant, Hot Applied, Elastomeric Type; for Portland Cement Concrete Pavements.

13. ASTM D5893: Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.03 SUBMITTALS

A. Product data for materials, including but not limited to: cementitious material, admixtures (air entraining, etc.), joint filler and sealants, reinforcing material, grout, anchors, curing compounds.

B. Concrete mix designs or job mix formulas for each proposed concrete mixture, including the following as applicable:
   1. Curbs & sidewalks, minor cast in place structures.
   2. Concrete paving areas.

C. Shop drawings for ADA detectible warning strips.

D. Field and laboratory test or quality control results including, but not limited to, the following:
   1. Subgrade proctor, compaction, moisture content.
   2. Base course gradation (if shown), proctor, compaction, moisture, depth.
   3. Concrete air entrainment.
   4. Concrete slump.
   5. Concrete compressive strength, f'c.
   6. Concrete bending strength .

1.04 QUALITY ASSURANCE

A. Testing Services: **The Owner will engage** a qualified independent testing agency to perform material evaluation tests described in this Section.
   1. Testing Agency Qualifications: Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

B. Ready-Mix Concrete Manufacturer Qualifications: Manufacturer must be certified according to the National Ready-Mix Concrete Association (NRMCA) Plant Certification Program.

C. Test sections. Build 10' sample test sections of walkways, curbs, and paving areas (10'x10') to demonstrate aesthetic affects and quality standards for materials and execution. Construct mock ups at approved locations only. Incorporate representative control and joints according to project requirements.
   1. Notify Testing Agency and Design Professional at least 7 days in advance of mock up construction.
   2. Obtain Owner or Design Professional approval of mockup prior to commencement of the work.
   3. Mockup may be incorporated into the work with approval.
   4. Demolish and remove each mockup from the Site when directed.

D. Comply with ACI 301 – Standard Specifications for Structural Concrete, unless otherwise modified by Contract Documents.

1.05 SITE CONDITIONS

A. Store materials only in areas designated for Contractor's use.

B. Complete all underground work and raise all necessary structures prior to paving operations.

C. Verify all grades and elevations for conformance with the Drawings before proceeding with work. The Design Professional reserves the right to make minor modifications by reasonable field adjustments prior to completion of subgrade work.

1.06 WEATHER LIMITATIONS

A. Cold weather protection - Whenever the air temperature may be expected to reach the freezing point, spread straw or other blanketing material to sufficient depth to keep concrete from freezing, or provide enclosure and a heating device capable of maintaining concrete temperature of at least forty-five (45) degrees five (5) days and maintain above freezing for the

entire specified curing period. The Contractor shall be responsible for removing and replacing any concrete injured by freezing or frost.

B. Placing During Hot Weather: The temperature of the concrete as placed shall not exceed 85° F, mixing water or aggregates may be cooled as necessary to maintain a satisfactory placement temperature. Do not place concrete when air temperatures exceed 95° F.

1.07 PAVEMENT DESIGN

A. Pavement sections are shown on the Plans and may include, but are not limited to, the following applications:
   1. Concrete Paving within the Right-of-Way.
   2. Heavy Duty Concrete Paving.
   3. Medium Duty Concrete Paving.

B. All depths shown or specified are measured after compaction or construction.

PART 2 - PRODUCTS

2.01 GENERAL

A. Cementitious materials. Type I or Type II Portland cement. Portland cement may be partially replaced with either fly ash or slag cement at the following maximum proportions:
   1. Fly ash, 15%
   2. Slag cement, 50%

B. Fine and coarse aggregates for concrete mixes. The ratio of fine to total aggregate shall be such as will produce a dense, homogeneous and workable mixture, which can be placed without segregation of materials and which will attain the design compressive strength. Aggregates shall comply with ASTM C33.

2.02 CONCRETE MIXTURES

A. Concrete for rigid paving (heavy duty and normal). Proportion such that the following are met:
   1. Minimum compressive strength at 28 days (f'c) = 4000 p.s.i
   2. Air content acceptance 3.5 to 6.0%, design air content 4.0 to 5.5%.
   3. Maximum slump = 4 inches.

B. Unless otherwise shown, proportion concrete for curb, general slab areas not intended for vehicular loading, walks, planters, seat walls, flumes and all other miscellaneous site work concrete to meet:
   1. Minimum compressive strength at 28 days (f'c) = 3000 p.s.i.
   2. Air content acceptance = 2.0 to 6.0%, design air content 2.5 to 6.0%.
   3. Maximum slump = 4 inches.

2.03 FILLER AND SEALER

A. Expansion joint material: 1/2 inch performed strips of cellular fiber impregnated with suitable bituminous binder. Filler shall conform to section area and extend through section to within 1/2 inch of top surface and conforms to ASTM D1751 or D1752, unless otherwise indicated.

B. Contraction Joint Sealer Material: Only apply joint sealant when otherwise shown in the Plans. Cold applied is the default.
   1. Cold applied silicone rubber type; ASTM D5893
   2. Hot-poured elastomeric type; ASTM D3406
   3. Single-Component Elastomeric Type (preformed); ASTM D2628

2.04 STEEL BAR, WELDED WIRE FABRIC

A. Provide steel bars and welded wire fabric of intermediate grade steel in specified sizes as shown on plans.

B. Plain-steel welded wire fabric: ASTM 1064, fabricated from steel wire formed into flat sheets.

C. Reinforcement bars: ASTM A615, Grade 60, deformed unless otherwise indicated. Cut bars true to length with ends square and free of burs.

D. Dowel bars: ASTM A615, Grade 60, plain steel bars unless otherwise indicated. Dowel bars shall be cut true to length with ends square and free of burs.

2.05 FORMS

A. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
   1. Use flexible spring steel forms or laminated boards to form radius bends as required.
   2. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete

2.06 EPOXY RESIN GROUT

A. Epoxy adhesive used for anchors and dowel bars in accordance with Type VIII per GDOT Standard Specification 886 unless otherwise noted.

2.07 DOVETAIL ANCHOR SLOTS

A. Galvanized steel, 22 gauge (0.8 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete forms.

2.08 DETECTABLE WARNING

A. Provide tactile warning surface (truncated dome) via pavers or monolithic concrete pour systems at ADA ramps.
   1. Provide shop drawings for proposed system.
   2. Dome Size: Diameter of 0.9 inch (23 mm), height of 0.2 inch (5 mm) and a center-to-center spacing of 2.35 inches (60 mm).
   3. Visual Contrast: Contrast visually with adjoining walking surfaces either light-on-dark or dark-on-light. The material used to provide contrast shall be an integral part of the truncated dome surface.
   4. Audible Contrast: Differ from adjoining walking surfaces in resiliency or sound-on-cane contact.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADES

A. Prepare subgrades as specified in Section 31 22 00 “EARTHWORK” to bring subgrade to required lines and grade for site improvements.

B. Maintain all subgrade in satisfactory condition, protected against traffic where necessary, and properly drained until site improvements are placed. Immediately in advance of concrete, check subgrade levels with templates riding the forms, correct irregularities, and re-compact any added fill material.

3.02 STRUCTURE LOCATIONS

A. Check for correct elevation and position of all manhole covers, valve boxes, and similar structures located within areas to be poured and make any necessary adjustments in such structures.

3.03 AGGREGATE BASES

A. If shown on the Plans- place, compact, and maintain aggregate bases in accordance with Division 32 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS”.

3.04 FORM CONSTRUCTION

A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the work and so forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to the following tolerances:
   1. Top of Forms not more than 1/8" in 10' from indicated elevation.
   2. Vertical face on longitudinal axis, not more than 1/4" in 10' from indicated alignment.

C. Clean forms after each use, and coat with form release agent after each use and as often as required to ensure separation from concrete without damage.

3.05 MIXING AND TRANSPORTING CONCRETE

A. Ready-Mixed Concrete - Certificates and laboratory strength test data shall be furnished from the mixing plant that concrete has a twenty-eight (28) day compressive strength when tested in accordance with methods described in ASTM Standard C39. No change shall be made in materials or the established mix without prior approval of the Design Professional.

B. Ready-mixed concrete shall be transported to the site in transit-mix or agitator trucks having watertight drums loaded not in excess of rated capacities. Concrete shall be delivered and discharged within one (1) hour after water is added to the cement. Concrete which, when delivered is not plastic and workable will be rejected.

C. Re-tempering of concrete that has partially hardened (remixing with or without additional cement, aggregate or water) will not be permitted.

3.06 PLACING CONCRETE

A. Subgrade- Place concrete only on a moist compacted subgrade or base, free from loose material. Place no concrete on a muddy or frozen subgrade.

B. Forms - All forms shall be free from warp, tight enough to prevent leakage of concrete, and substantial enough to maintain their shape and position without springing or settlement when concrete is placed or vibrated. Forms shall be staked, braced, and/or tied together securely. Forms shall be clean and those for surfaces to be exposed shall produce a smooth, even finish without fins or board marks. Set forms for slabs on ground at exact finished grade. Check for line and grade and correct as necessary immediately before concreting. Provide uniform bearing for such forms.

C. Reinforcement shall be accurately placed, and securely supported and fastened to prevent movement during placement of concrete.

D. Concrete shall be deposited so as to require as little rehandling as practical. Placing shall be continuous between transverse joints or in individual sections of the work. Vibrate concrete thoroughly along forms and expansion joints, and work carefully into corners and around reinforcement. Tamp and screed to a dense mass. If the temperature may be expected to fall below forty (40) degrees F within twenty-four (24) hours after concrete is placed, heat water and aggregates to bring the temperature of concrete mix to at least fifty (50) degrees.

E. Do not remove forms for at least 24 hours after concrete has been placed. After forms are removed, clean ends of joints and point-up any minor honeycombed areas. Remove and replace sections with major defects, as directed by Design Professional.

3.07 JOINTS

A. General: Construct expansion, control (also may be called weakened-plane or contraction, and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

C. Control Joints: Provide control (contraction) joints, sectioning concrete into areas not to exceed 25 feet in length. Construct control joints for a depth equal to at least 1/4 of concrete thickness, as follows:

1. Tooled Joints: Form control joints in fresh concrete by grooving top portion of concrete. Finish edges with a jointer. Joints in walks shall be 1/4" x 1" deep and at a spacing equal to walk width.
2. Sawed Joints: Form control joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

D. Construction Joints: Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such pours terminate at expansion joints. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

E. Expansion Joints: Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

3.08 CONCRETE CURB AND GUTTER

A. Furnish and install formed concrete curb and gutter as detailed. Curb and gutter shall be accurately formed to a true, clean, straight, even profile. Unless otherwise shown:
   1. Provide expansion joints 40 feet on center. Control (tooled) joints shall be provided at 10 feet on center.
   2. Finish of concrete shall be a fine broom finish.

B. All curves shall be accurately formed to detail.

3.09 CONCRETE WALKS AND FLUMES

A. Concrete walks shall be four (4) inches thick and of width as shown on the Site Plan. Unless otherwise shown:
   1. Provide expansion joints through walks at a maximum of 40 feet on-center and control (tooled) joints at the same intervals as the width of the walk.
   2. Slope walks toward curb.
   3. Finish shall be a fine broom finish.
   4. Finished surfaces shall be smooth and not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiencies in section thickness is up to ¼”.

3.10 SAND BLAST FINISH

A. Provide abrasive blast (sand blast) finish where indicated on the Drawings.

B. Perform sand blasting 24 to 72 hours after casting when concrete strength is between 1000 and 1500 psi.

C. Surface Continuity: Perform sand blasting in a continuous manner, utilizing same crew or personnel.

D. Depth of Cut: Use an abrasive grit of proper tyhpe and gradation to expose aggregate and surrounding matrix surfaces to match the design reference sample or mock up as follows:
   1. Brush: Remove cement matrix to eliminate surface sheen and expose face of fine aggregate. No reveal.
   2. Light: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color. Maximum reveal 1/16 inch.
   3. Medium: Generally, expose coarse aggregate with slight reveal. Max reveal ¼”.
   4. Heavy: Expose and reveal coarse aggregate to a maximum projection of one-third of its diameter, reveal ¼ to ½ inch.

E. Sand blasting: Blast corners and edges carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match the mockup.

F. Cleaning: After sand blasting is complete, clean surface with commercial concrete cleaner according to manufacturer instructions and recommendations. Thoroughly neutralize and flush cleaning solution from finished surface with water under pressure.

G. Protect adjacent surfaces and materials from washing and run-off.

3.11 HANDICAP RAMP

A. Locate and construct concrete handicap ramps per Plan and details. Provide tactile warning surface (truncates dome) via pavers or monolithic concrete pour systems provide shop

drawings for said system. Apply a fine broom finish. Do not exceed eight (8) percent slope at any point.

3.12 HEAVY DUTY CONCRETE PAVING

A. Place steel reinforcing where indicated prior to placing concrete.

B. Pour heavy duty concrete mix in forms so that when consolidated struck off, compacted and finished, paving will be to the thickness shown on the Plans. If not shown on the Plans, paving thickness shall be eight (8) inches.

C. Locate expansion joints at 40' o.c. and control joints at minimum of 10’ o.c. for each pavement lane.

D. Test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.

E. Compact in such a manner that aggregate is forced down and not less than three eights (3/8) inch of mortar is left on top. Apply heavy broom finish.

3.13 CURING CONCRETE

A. Protect unhardened concrete from rain and flowing water and protect concrete against loss of moisture and rapid temperature change for at least a 7 day curing period.

B. Impervious membrane - Where applicable, concrete will be cured through the application of a transparent, impervious membrane of a type approved by the Design Professional. The liquid shall contain a fugitive dye and shall be of such composition as not to react with the concrete nor alter its color. Apply the liquid immediately after free water has disappeared from the finished surface of the concrete; apply in the form of a fine mist and in such manner as to cover the surface with a uniform film, ample to seal the surface thoroughly and without marring the concrete finish in accordance with manufacturer recommendations. Keep workmen, equipment and materials off the membrane during the curing period, except as required for joint sawing operations and surface tests.

3.14 TOLERANCES

A. Elevation tolerance for finish grade surfaces are:
   1. General areas +- 0.04 ft unless field adjustments are directed or approved by the Design Professional.

B. Cross slope, thickness, and smoothness tolerances are as follows:

Layer	**Cross Slope[2]**	**Thickness**	**Smoothness [1]**
Base (Aggregate or treated)	+- 1.0%	+- 1/4 in	1/2 inch
Finished Concrete Surface (Pedestrian Areas)	+- 0.5%	+- 1/4 in	5/16 inch
Curb Sections	+- 0.5%	+- 1/4 in	1/4 inch
Rigid Pavement Sections	+- 0.3%	+- 1/4 in	1/4 inch

[1] In any direction within a single plane of asphalt, do not exceed the gap below a 10 foot straightedge resting on high spots.
[2] Cross slope tolerance does not alleviate the requirement to provide positive drainage or to comply with ADA accessibility requirements.

3.15 TESTING- QUALITY ACCEPTANCE

A. Inspections: Prior to commencement of portions of the work, the Testing Agency shall be notified 3 days in advance to verify the following items:
   1. Subgrade preparation, stiffness (proofrolling).
   2. Subgrade profile, cross slope, and elevation.
   3. Grades, elevations, compaction, surface smoothness of base aggregate if used.

B. Additional testing (or retesting) after failing tests shall be paid for by the Contractor.

C. Replace concrete in all areas (between joints) that fail to meet cross slope, thickness, and smoothness tolerances. Also, replace concrete in all areas that does not meet material testing acceptance criteria shown below.

D. Appearance: Exposed surfaces of finished work shall not exhibit excessive cracking, discoloration, form marks, or tool marks which are inconsistent from the overall appearance. Such deficient surfaces shall be removed and replaced between joints.

E. Minimal testing requirements for Owners Quality Assurance are summarized below. Contractor may elect to collect additional samples and perform additional tests, or prepare additional specimens for testing at its sole discretion in accordance with their own quality control program.

Material or Product	**Characteristic /Test Method**	**Minimum Sample Frequency**	**Acceptance Criteria**	**Sampling Point**
Concrete Mixture	Compressive Strength *ASTM C31, ASTM C39*	Min. 1 composite sample per day (2 sets of 2 standard 6”x12” cylinder), per 250 CY placed, per each class. *ASTM C172*	Average of three consecutive tests exceed specified strength, and no test is deficient by more than 500 psi.	Molded onsite, lab test.
	Air Content *ASTM C173, or C231*	(min) 2 tests per day, per class placed.	+- 0.5% of the design air content	On site
	Slump *ASTM C143*	(min) 2 tests per day, per 250 CY placed, per each class.	Refer to mix composition.	On site
Aggregate base courses	Gradation; max dry density, optimum moisture by modified proctor, *ASTM D1557*	1 per source	Gradation within limits.	Stockpile at source
	Compaction *GDT 21, 59, ASTM D6938*	1 per 2000 sq yards of finished concrete surface, per lift	100% of max dry density, ±2% optimum moisture *	In-place, prior to next lift

F. Deficient work that test reports and inspections indicated does not comply with this specification, shall be fully replaced. Corrective action not involving full replacement may be approved by the Architect in writing, provided such corrective action equals or betters the original specification

3.16 MAINTENANCE OF CONCRETE SITE IMPROVEMENTS

A. Concrete site improvements damaged during construction shall not be spot patched. If a portion of a panel or curb is damaged between control or expansion joints, the entire panel or curb shall be replaced.

END OF SECTION

SECTION 32 18 23.53
TENNIS COURT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes tennis court installation.

B. Extent of tennis court construction is indicated on the Drawings.

C. Tennis court work includes, but is not limited to, the following:
   1. Tennis court pavement.
   2. Tennis court equipment and accessories.
   3. Chain link fence enclosure.

1.03 SUBMITTALS

A. Section Cross Reference: Refer to Division 01 Submittals Section for general requirements.

B. Product Data: Submit, for information only, manufacturer's specifications, product data installation instructions, and general recommendations for each material required.

C. Samples for Initial Selection: PVC colors in form of manufacturer's color chart or six (6)inch lengths of actual fabric wire showing colors available.

D. Samples for Verification: PVC color in form of six (6) inch lengths of actual fabric wire to be used in color selected.

E. Installer Certification: Submit written documentation that Installer complies with requirements of "Installer Qualifications" below.

1.04 QUALITY ASSURANCE

A. Industry Reference Standards: Refer to Division 01 References Section:
   1. U.S. Tennis Court and Track Builders Association (USTC & TBA):
   2. United States Tennis Association (USTA):
   3. Chain Link Fence Manufacturer's Institute (CLFMI):

B. Qualifications:
   1. Installer Qualifications: Engage a firm specializing in tennis court installation. Installer shall have successfully completed at least twenty (20) tennis court installation projects of the same materials, design and of similar size and scope of work to that indicated for this Project.
      a. Firm Experience Period: Ten (10) years of experience.

C. Single Source Responsibility: Obtain primary materials, color coating systems and accessories from a single source.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in original unopened containers with labels informing about manufacturer, product name, color, expiration date, pot life and mixing instructions.

B. Store and handle materials in strict compliance with manufacturer's recommendations. Protect against weather, soil, contamination from earth and other materials and physical damage during storage and construction.

1.06 PROJECT CONDITIONS

A. Installer shall review installation procedures and coordinate with other work that will be affected by tennis court installation.

B. Weather Limitations:

1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade.
2. Apply prime and tack coats when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
3. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40 deg F (4 deg C) and when base is dry. Base course may be placed when air temperature is above 35 deg F (1 deg C) and rising.

C. Grade Control: Establish and maintain required lines and elevations.

D. Apply color coat system only when the temperature of surface to be coated and surrounding air temperatures are between 50 deg F (10 deg C) and 95 deg F (35 deg C).

E. Do not apply color coat system in snow, rain, fog or mist; when the relative humidity exceeds 85 percent; to damp or wet surfaces, or if forecasted weather conditions will not permit work to be performed in accordance with manufacturer's recommendations.

F. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operations.

G. Field Measurements: Check actual dimensions of chain link fence by accurate field measurements before fabrication of wind screens to determine actual length from tension bar to tension bar.

H. Field Measurements: Verify layout information for fences and gates shown on the Drawings. Verify dimensions by field measurement.

PART 2 - PRODUCTS

2.01 MATERIAL/PRODUCT REQUIREMENTS

A. Base Course Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone and natural or crushed sand complying with ASTM D 2940 for base material.

B. Asphalt Materials: Refer to Division 32, Asphalt Paving Section, for requirements.

C. Tennis Court Binder: High strength, acrylic bonding liquid designed for mixing with sand and portland cement.
   1. Color: Black.

D. Tennis Court Filler Coat: 100 percent acrylic emulsion, and sand.
   1. Color: Black or neutral.

E. Filled Colorcoat: 100 percent acrylic emulsion, pigments and sand.
   1. Color: To be determined by Owner.

F. Colorcoat: 100 percent acrylic emulsion coating, highly pigmented with prime color, and reinforcing pigments.
   1. Color: To be determined by Owner.

G. Line Marking Paint: 100 percent acrylic emulsion for use on tennis courts.
   1. Color: White.

H. Tennis Net Post and Sleeves: Provide metal posts and sleeves complying with the following requirements:
   1. Steel Pipe: ASTM A 53, standard weight (schedule 40).
      a. Yield Strength: 1200 lbs minimum.
      b. Tensile Strength: 1500 lbs minimum.
      c. Galvanized finish for exterior installations.
   2. Post Size: 3 1/2 inches outside diameter.
   3. Sleeve Size: 1/2 inch greater than outside diameter of post.
   4. Finish: Polyurethane coating.
      a. Color: Black.

2.02 NET AND NET POST EQUIPMENT

A. Net post shall be equipped with a cable guide top, one (1) galvanized eye bolt and a mechanical tensioning device which is limited in the amount of force applied to the net post, not to exceed one-half (1/2) post yield strength of one of the following types:
   1. Worm Gear.
   2. Ratchet Reel.
   3. Screw-type.

B. Center Strap Anchor: Galvanized steel pipe, adjustable type with galvanized one-quarter (1/4) inch diameter pin centered through pipe.

C. Net: Provide tennis net composed of the following components and otherwise conforming to the regulations of the USTA.
   1. Net Body: Weather resistant synthetic netting of one and three-quarters (1-3/4) inch square mesh.
      a. Tensile Strength of Twine: 275 lbs minimum.
      b. Size: 41 feet 9 inches long by 3 feet 3 inches high.
      c. Color: Black.
   2. Headband (Top Binding): Two ply white synthetic or canvas treated for resistance to sunlight and mildew lock stitched the length of the net.
   3. Cable: Multi-strand galvanized steel wire rope, 3/16 inch minimum core diameter.
      a. Length: 47 feet.
      b. Tensile Strength: 2600 lbs minimum.
   4. Side Bindings (Tapes): Black synthetic material treated for resistance to sunlight deterioration with fine nickel or brass grommets to accommodate lacing twine and pockets to accept dowels.
   5. Bottom Bindings (Tapes): Black synthetic material similar to side bindings with long life abrasion resistance.
   6. Dowels: Wood, metal or fiberglass, five-eighths (5/8) inch diameter, forty (40) inch long maximum.
   7. Tie Strings: Black UV resistant, synthetic cord, sixty (60) inches long minimum.
      a. Breaking Strain: 275 lbs minimum.
   8. Lacing Twine: Same as tie strings, ninety-six (96) inches long minimum.
   9. Center Strap: White strap from canvas or synthetic material treated for UV and mildew resistance with a galvanized spring loaded hook attached at the bottom.
      a. Size: Two (2) inches wide.

2.03 CHAIN-LINK FENCE FABRIC

A. Steel Chain Link Fence Fabric: Height indicated on Drawings. Provide fabric fabricated in one-piece widths for fencing in height of twelve (12) feet (3.6 m) and less. Comply with CLFMI's "Product Manual" and with requirements indicated below:
   1. Mesh and Wire Size: 2-inch (51 mm) mesh, 9 gauge 0.148-inch (3.76mm) diameter.
   2. Zinc-Coated Fabric: ASTM A392, with zinc coating applied to steel wire before weaving according to ASTM A817, Type II, zinc-coated galvanized with the following minimum coating weight:
      a. Class 2: Not less than 2 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
   3. PVC Coated Fabric: ASTM F 668, Class 2b over metallic-coated steel wire.
      a. Metallic Coating: Zinc.
      b. Color: As selected by Landscape Architect from manufacturer's full range complying with ASTM F 934.

B. Selvage: Knuckled at both selvages.

2.04 INDUSTRIAL FENCE FRAMING

A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F 1083. Comply with ASTM F 1043, Material Design Group IA, external and internal coating Type

A, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) zinc; and the following strength and stiffness requirements:
1. Line, End, Corner, and Pull Posts and Top Rail: Per requirements for Heavy Industrial Fence.

B. Post Brace Rails: Match top rail for coating and strength and stiffness requirements. Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two(2) brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.

C. Top Rails: Fabricate top rail from lengths twenty-one (21) feet (6.4 m) or longer, with swedged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain-link fence.

D. Intermediate Rails: Match top rail for coating and strength and stiffness requirements.

2.05 TENSION WIRE

A. General: Provide horizontal tension wire at the following locations:
1. Location: Extended along bottom of fence fabric.

B. Metallic-Coated Steel Wire: 0.177-inch (4.5 mm) diameter, marcelled tension wire complying with ASTM A 824 and the following:
1. Coating: Type II, zinc coated (galvanized) by the hot-dip process with the following minimum coating weight:
a. Class 2: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of uncoated wire surface.

2.06 INDUSTRIAL SWING GATES

A. General: Comply with ASTM F 900 for the following swing-gate types:
1. Single gate.
2. Double gate.

B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

C. Frames and Bracing: Fabricate members from same material and finish as fenceframework with outside dimension and weight according to ASTM F 90 for the following gate fabric height:
1. Gate Fabric Height: More than 6 feet (1.82 m).

D. Frame Corner Construction: As follows:
1. Welded.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900 for the following gate fabric heights and leaf widths:
1. Gate Fabric Height by Leaf Width: 6 feet (1.83 m) or less by 4 feet (1.22 m) or less.
2. Gate Fabric Height by Leaf Width: 6 feet (1.83 m) or less by over 4 feet (1.22 m)but not over 10 feet (3.05 m).
3. Gate Fabric Height by Leaf Width: 6 feet (1.83 m) or less by over 10 feet (3.05 m) but not over 18 feet (5.49 m).
4. Gate Fabric Height by Leaf Width: Over 6 feet (1.83 m) by 6 feet (1.83 m) or less.
5. Gate Fabric Height by Leaf Width: Over 6 feet (1.83 m) by over 6 feet (1.83 m) but not over 12 feet (3.66 m).
6. Gate Fabric Height by Leaf Width: Over 6 feet (1.83 m) by over 12 feet (3.66 m) but not over 18 feet (5.49 m).
7. Gate Fabric Height by Leaf Width: Over 6 feet (1.83 m) by over 18 feet (5.49 m) but not over 24 feet (7.32 m).

F. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops, and, for each gate leaf more than five (5) feet (1.5 m) wide, keepers. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.07 FITTINGS

A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F 626.

B. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide weathertight closure cap for each post.
   1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Hot-dip galvanized pressed steel or round steel tubing. Not less than six (6) inches (153 mm) long.
   2. Rail Clamps: Hot-dip galvanized pressed steel. Provide line and corner boulevard clamps for connecting intermediate rails in the fence line to line posts.

E. Tension and Brace Bands: Hot-dip galvanized pressed steel.

F. Tension Bars: Hot-dip galvanized steel, length not less than two (2) inches (50 mm) shorter than full height of chain-link fabric. Provide one (1) bar for each gate and end post, and two (2) for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F 626:
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
   2. Hot-Dip Galvanized Steel: 0.106-inch- (2.69-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Pipe Sleeves: For posts set into concrete, provide preset hot-dip galvanized steel pipe sleeves complying with ASTM A 53, not less than six (6) inches (150 mm) long with inside dimensions not less than one-half (1/2) inch (13 mm) more than outside dimension of post, and flat steel plate forming bottom closure.

2.08 PRIVACY SLATS

A. Material: PVC, UV-light stabilized, not less than 0.023 inch (0.58 mm) thick, sized to fit mesh specified for direction indicated.

B. Color: As selected by Owner/Architect from manufacturer's full range.

2.09 WINDSCREENS

A. Provide open mesh tennis windscreens with the highest ultraviolet light, abrasion and mildew resistance fabricated from one of the following materials:
   1. Vinyl Coated Polyester: Woven fabric made from polyester material weighing at least 3.0 oz per square yard and coated after weaving with a 4.0 oz per square yard dark color vinyl.
   2. Polypropylene: Woven fabric made form polypropylene yarns weighing 4.75 oz or more per square yard. The yarns shall be a dark color.
   3. Size: 9 feet high by 66 feet long maximum.

B. Hems: Reinforced and double stitched.

C. Reinforcing Tape: Center reinforced seam grommeted twelve (12) to eighteen (18) inches on center and double stiched.

D. Thread: All hems and seams shall be sewn with a heavy duty weather and ultraviolet resistant polyester thread.

E. Grommets: No. 2 or No. 3 solid brass with plain washers; twelve (12) to eighteen (18) inches on center.

F. Air Vents: Open or flat type, finished, ten (10) foot on center maximum spacing.

G. Fastener: Lacing cord; three-sixteenth (3/16) inch nylon polyester or polypropylene.

2.10 CONCRETE

A. Section Cross Reference: Refer to Division 03, Cast-In-Place Concrete Section, for requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces indicated to receive court pavement, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of courts. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that base is dry and ready to support asphalt paving loads. Gradients and elevation must be correct prior to installation.

C. Stake locations of fence lines, gates and terminal posts. Do not exceed intervals of fivehundred (500) feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.02 PREPARATION

A. Subgrade Preparation: Excavate and compact soil subgrade. Compact soil no less than 95 percent maximum dry density as determined in accordance with ASTM D 698.

B. Proof roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Do not proceed with installation of asphalt paving until deficient subgrades have been corrected and are ready to receive subbase for asphalt pavement.

3.03 INSTALLATION-GENERAL

A. Tolerances: Finish the surfaces of each layer within the court boundaries to be free from irregular surface changes and within the following tolerances.
   1. Subgrade: Plus or minus one (1) inch.
   2. Base Course: Plus or minus one-half (1/2) inch in ten (10) feet - zero (0) inches measured in each direction
   3. Asphalt Pavement: Refer to Division 32, Asphalt Paving Section, for requirements.
   4. Filled Color Coat: Plus or minus one-sixteenth (1/16) inch in ten (10) feet - zero (0)inches measured in any direction.

3.04 BASE COURSE

A. Place aggregate for compacted base course over properly prepared and compacted subgrade. Provide compacted thickness of base indicated to allow for thickness of asphalt pavement. Compact base to 95 percent of maximum dry density as determined in accordance with ASTM D 698.

B. Shape base course to required crown elevations and cross-slope grades.

C. When thickness of compacted base course is six (6) inches or less, place materials in a single layer.

D. Treat base course with suitable soil sterilizer to prohibit growth of grass and weeds.

3.05 ASPHALT PAVEMENT

A. Section Cross Reference: Refer to Division 32, Plant-Mix Asphalt Paving Section, for requirements.

3.06 FINISH COURSE AND COLOR FINISH

A. Examination: Prior to application of finish course water flood entire court surface and allow to drain. Any areas (bird baths) holding water deep enough to cover a nickel (American five cent piece) shall be patched and leveled as specified herein.

B. Preparation: Surface course and subsurface materials shall have been installed to proper slope requirements and specifications in accordance with the USTC & TBA recommendations and must be thoroughly cured before application of any filler or color finish materials.

1. Prior to placing finish course material layers, the underlying courses shall be cleaned of all loose and foreign materials.
2. Apply finish course and color finishes to day surfaces.

C. Patch Mix: Patch and level all “bird baths” in asphaltic concrete surface course with patching mix in accordance with recommendations of color finish system manufacturer.
   1. Apply patch mix in multiple applications until “bird baths” are minimized.

D. Filler Coat: Apply filler coat over properly prepared and cured surface as recommended by the color finish manufacturer.
   1. Apply filler coat in multiple applications to form a smooth, dense uniform underlay for the color finish system.
      a. Total Application Rate: Thirty (30) to forty (40) gallons per one-thousand (1000) square feet, prior to dilution.
   2. Apply successive coats in a direction perpendicular to the direction of application of the previous coat.
   3. After the filler coat has thoroughly cured, roll the entire areas with a two (2) to four(4) ton steel-wheel tandem roller.
   4. Water flood entire court surface and allow to drain. Any areas holding water of onesixteenth (1/16) inch depth after forty-five (45) minutes shall be leveled with filler coat allowed to cure and then rolled as described above.

E. Filled Colorcoat: Filled colorcoat shall be applied to a clean, dry underlying surface in accordance with recommendations of color finish system manufacturer.
   1. Apply filled color coat in multiple applications to form a surface smooth, free of ridges, valleys, tool marks and depressions.
      a. Total Application Rate: Eleven (11) to eighteen (18) gallons per one-thousand (1000) square feet, prior to dilution.
   2. Applications shall not be made until preceding applications are thoroughly cured.
   3. Apply successive coats in a direction perpendicular to the direction of application of the previous coat.
   4. Dilute filled colorcoat with water to obtain proper application consistency per themanufacturer’s recommendations.
   5. Color of filled colorcoat shall be same as finish colorcoat.

F. Colorcoat: Colorcoat shall be applied to a clean, dry underlying surface in accordance with recommendations of color finish system manufacturer.
   1. Apply filled colorcoat in multiple applications to form a surface smooth, free of ridges, valleys, tool marks and depressions.
      a. Total Application Rate: Four (4) to eight (8) gallons per one-thousand (1000) square feet, prior to dilution.
   2. Application shall not be made until preceding applications are thoroughly cured.
   3. Apply successive coats in a direction perpendicular to the direction of application ofthe previous coat.
   4. Dilute color coat with water to obtain proper application consistency per the manufacture’s recommendations.

3.07 PLAYING LINES

A. Locate, mark and paint playing lines forty-eight (48) hours minimum after completion of the court surface construction.

B. Mark and spray all lines. Overspray will not be acceptable.

C. Do not use traffic, oil, alkyd, or solvent -vehicle type paint. Paint shall not cause lifting, crazing, peeling or other damage of the surface.

D. Paint shall be applied in accordance with recommendation of color finish system manufacturer.

E. Allow court to cure for a minimum of four (4) days following the application of the playing lines prior to opening courts to play.

3.08 NET POST AND NET INSTALLATION

A. Post and post sleeves shall be set where indicated on the Drawings. Preset and anchor sleeves to concrete.

B. Center strap anchor shall be set where indicated on the Drawings. Set anchor in concrete.

C. Position tennis net so that center height shall be thirty-six (36) inches above the court surface.

3.09 CHAIN LINK FENCE INSTALLATION, GENERAL

A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
   1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

C. Post Setting: Using mechanical devices to set line posts per ASTM F 567 is permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.
   1. Dimensions and Profile: As indicated on the Drawings.
   2. Exposed Concrete Footings: Extend concrete two (2) inches (50 mm) above grade, smooth, and shape to shed water.
   3. Posts Set into Concrete in Curb: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and slope topof concrete curb to drain water away from post.

3.10 CHAIN-LINK FENCE INSTALLATION

A. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment and as indicated on Drawings.

B. Line Posts: Space line posts uniformly at ten (10) feet (3.05 m) o.c.

C. Post Bracing Assemblies: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two-thirds (2/3) fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

D. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of twenty-four (24) inches (609 mm) o.c. Install tension wire in locations indicated before stretching fabric.
   1. Top Tension Wire: Install tension wire through post cap loops.
   2. Bottom Tension Wire: Install tension wire within six (6) inches (150 mm) of bottom of fabric and tie to each post with not less than same gage and type of wire.

E. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.

F. Intermediate Rails: Install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.

G. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave two (2) inches(50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

H. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than fifteen (15) inches (380 mm) o.c.

I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
   1. Maximum Spacing: Tie fabric to line posts twelve (12) inches (304 mm) o.c. and to braces twenty-four (24) inches (609 mm) o.c.

J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

K. Privacy Slats: Install slats in direction indicated, securely locked in place.
   1. Vertically, for privacy factor of 80 to 85.
   2. Diagonally, for privacy factor of 80 to 85.

L. Tennis Court Fencing: Construct court fence according to ASTM F 969.

3.11 GATE INSTALLATION

A. General: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.12 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.13 CLEANING AND PROTECTION

A. Remove all surplus materials, debris, and equipment resulting from work of this Section and haul off site.

B. Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures court being without damage or deterioration during subsequent construction and until Date of Substantial Completion.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Vinyl coated chain link fences, gates and accessories.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. American Society for Testing Materials (ASTM)
   1. ASTM C1107 – Cement grout.
   2. ASTM F567 – Installation of chain link fence.
   3. ASTM F626 – Fence fittings.
   4. ASTM F900 – Commercial swing gates.
   5. ASTM F934 – Standard colors for polymer-coated chain link fence.
   6. ASTM F1043 – Protective coatings on steel fence framework.
   7. ASTM F1083 – Galvanizing for fence structures
   8. ASTM F1664 – PVC coated steel wire.

1.03 SUBMITTALS

A. Manufacturer's literature and data: Cut sheets or specifications indicating material compliance and specified options for chain link fencing, gates and all accessories.

B. Shop drawings: Site plan showing layout of fence location with dimensions, location of gates and opening size, cleared area, elevation of fence and gates, details of attachments and footings.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company having manufacturing facility/facilities specializing in manufacturing chain link fence products with at least 5 years' experience.

B. (Sub) Contractor: Demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and have at least 5 years' experience.

1.05 SITE CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures.

PART 2 - PRODUCTS

2.01 CHAIN LINK FABRIC

A. Fabric height: Fabric height shall be as noted on the Drawings.

B. Fabric shall be PVC coated galvanized steel wire fabric provided in one-piece heights complying to ASTM F 668, Class 2a.

C. Mesh size:
   1. Fencing mesh size (except tennis): 2 inches.
   2. Tennis court fencing mesh size: 1-3/4 inches.

D. Core wire diameter: 0.148 inches (9 gauge).

E. PVC coating: 6 gauge finished diameter with a minimum thickness of 0.015 inches applied in accordance with ASTM F 1043.

F. PVC coating color: Black, per ASTM F 934.

G. Selvages: Knuckled top selvage and knuckled bottom selvage.

2.02 FENCE FRAMING

A. Posts and rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
   1. Group: IA, round steel pipe, Schedule 40.
   2. Fence height shall be as noted on the Drawings.
   3. Strength requirement: Light industrial according to ASTM F 1043.
   4. Post diameter, thickness and weight:
      a. Fence heights 4 to 6 feet
         - Line post: 2.375 inches (2-3/8” nominal o.d.), 0.154 inches, 3.65 lb/ft.
         - End, corner and pull post: 2.875 inches (2-7/8” nominal o.d.), 0.203 inches, 5.79 lb/ft.
      b. Fence height 8 to 10 feet:
         - Line post: 2.875 inches (2-7/8” nominal o.d.), 0.203 inches, 5.79 lb/ft.
         - End, corner and pull post: 4.000 inches (4” nominal o.d.), 0.237 inches, 10.80 lb/ft.
      c. Swing gate post: According to ASTM F 900
   5. Top rails, rails and braces diameter and thickness:
      a. Top Rails: 1.90 inches (1-7/8” nominal o.d.), 0.145 inches, 2.72 lb/ft.
      b. Rails and braces: 1.66 inches (1-5/8” nominal o.d.), 0.140 inches, 2.27 lbs/ft.
   6. Coating for steel framing: PVC coated finish in accordance with ASTM F 1043 applied with a minimum thickness of 10-mils in black color to match the fabric.

2.03 TENSION WIRE

A. PVC coated 0.177-inch diameter (7 gauge) metallic coated steel core wire complying with ASTM F 1664 Class 2a.

2.04 SWING GATES

A. General: Comply with ASTM F 900 for swing gate types.
   1. Metal pipe and tubing: Galvanized steel gate framing complying with ASTM F 1043 and ASTM F 1083.
   2. Coating for steel framing: PVC coated finish in accordance with ASTM F 1043 applied with a minimum thickness of 10-mils in black color to match the fabric.

B. Frames and bracing: Fabricate members from round, tubing with outside dimension and weight according to ASTM F 900 and the following:
   1. Gate Fabric Height: 2 inches less than adjacent fence height.
   2. Leaf Width: As indicated.
   3. Frame Members Diameter: 1.90 inches.

C. Frame corner construction: Welded or assembled with corner fittings.

D. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.05 FITTINGS

A. General:
   1. Comply with ASTM F 626.
   2. Coating for fittings: PVC coated finish applied with a minimum thickness of 10-mils in black color to match the fabric.

B. Tension and brace bands: PVC coated 12 gauge galvanized pressed steel a minimum width of ¾ inch.

C. Top rail sleeves: PVC coated pressed-steel or round-steel tubing not less than 6 inches long.

D. Tie wires and hog rings: PVC coated nine 9 gauge galvanized steel or aluminum core wire for attachment of fabric to framing and tension wire.

E. Truss rods and tightener:
   1. PVC coated steel rods with minimum diameter of 3/8 inch.
   2. PVC coated pressed steel tightener.

F. Terminal post caps, line post loop tops, rail and brace ends, and boulevard clamps: PVC coated galvanized pressed steel.

2.06 GROUT AND ANCHORING CEMENT

A. Grout for post footings in concrete, masonry, or bedrock: Non-shrink grout complying with ASTM C 1107.

B. Concrete for post footings in soil: 28-day compressive strength of 3,000 psi (minimum).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for conditions for compliance with requirements for site clearing, grading, paving, and other conditions affecting performance of the work.

B. Do not begin installation before final grading and clearing is completed.

3.02 PREPARATION

A. Mark locations of fence lines, gates, and terminal posts.

B. Clear, grub, grade, and remove debris for the fence line.

3.03 INSTALLATION

A. General:
   1. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
   2. Install fencing on established boundary lines inside property line.

B. Excavation:
   1. Drill holes for post footings in firm undisturbed or compacted soil.
   2. Bedrock excavation: if bedrock is encountered before reaching required depth, excavate to required depth for setting post in soil or 18 inches, whichever is less, and provide a 2 inch larger diameter than the outside diameter of the post.
   3. Clear loose material, fine grade area around finished post footings and uniformly spread and stabilize excavated material on site.

C. Terminal post locations:
   1. Install terminal line posts at each fence termination and change in horizontal or vertical direction of 30° or more.

D. Line post spacing:
   1. For fence heights of 4 to 8 feet, space line posts uniformly 10 feet on center
   2. For fence heights of 10 feet, space line posts 8 feet on center

E. Setting Posts:
   1. Set post in soil: Set posts in concrete footing.
      a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
      b. Footing depths.
         - Fence heights of 4 to 6 feet, footing depth shall be 36”.
         - Other fence heights footing depth shall be a minimum of 24” plus an additional 3 inches for each 1 foot increase in the fence height over 4 ft., unless otherwise noted.
      c. Footing diameters based on diameter of fence post.
         - 3 inch fence post- footing diameter is 12 inches.
         - 4 inch fence post- footing diameter is 16 inches.

- Other fence heights footing diameter is a minimum of 4 times greater than O.D. of post, unless otherwise noted.

d. Set post 3 inches above bottom of footing excavation.
e. Thoroughly consolidate concrete into the hole to remove voids.
f. Finish top of concrete sloping away from post for positive drainage.

2. Set post in bedrock: Set posts in non-shrink grout.
   a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with non-shrink grout or mechanical devices.
   b. Footing depth shall be per bedrock excavation requirements listed above.
   c. Footing diameter is a minimum of 2 inches greater than O.D. of post, unless otherwise noted.
   d. Set posts 3 inches above bottom of footing excavation.
   e. Thoroughly consolidate non-shrink grout into the hole to remove voids.
   f. Finish top of grout sloping away from post for positive drainage.
3. Set posts in structures:
   a. Set posts in steel sleeves with non-shrink grout.
   b. Install post in concrete retaining walls, curbs, slabs, or similar construction in galvanized pipe sleeves set into the concrete or built into the masonry as shown on the drawings.
   c. Sleeve depth and diameter shall be as noted on drawings.
   d. Set sleeves plumb and one-half inch above the finished structure.
   e. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   f. Thoroughly compact non-shrinking grout between sleeve and post.
   g. Finish top of grout to divert stormwater away from the post.
4. Gate Posts:
   a. Gate posts require larger footings than listed above.
   b. Gate post footing dimensions to comply with ASTM F 567.

F. Post Bracing and Intermediate Rails:
   1. Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
   2. Locate horizontal braces at mid height of fabric 6 feet or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
   3. For fence height of 10 feet, install an intermediate rail at a height of 5’-0”.

G. Tension Wire:
   1. Install according to ASTM F 567, maintaining plumb position and alignment of fencing.
   2. Install tension wire 4 inches up from the bottom of the fabric.
   3. Pull wire taut, without sags.
   4. Secure tension wire to terminal post using a brace band.
   5. Install tension wire in locations indicated before stretching fabric.

H. Top Rail:
   1. Install according to ASTM F 567, maintain a plumb position and alignment of fencing.
   2. Install twenty-one 21 foot lengths of rail continuously through line post caps, bending to radius for curved runs and terminating into terminal post by a brace band and rail end.
   3. Splice rail using top rail sleeves.

I. Bottom Rails:
   1. Install and secure to posts with fittings, in locations indicated on the drawings.

J. Chain-Link Fabric:
   1. Apply fabric to outside of the framework.
   2. Leave approximately 1 inch, without exceeding 2 inches, between finish grade or surface and bottom selvage, unless otherwise noted.

3. Pull fabric taut and anchor to framework so fabric remains under tension after pulling force is released.
4. Attach to terminal post by threading the tension bar through the fabric; secure the tension bar to the terminal post with tension bands and 5/16 in. carriage bolts spaced no greater than 12 inches on center
5. Secure fabric to the line post with tie wires spaced no greater than 12 inches on center.
6. Secure fabric to rail with tie wires spaced no greater than 18 inches on center.
7. Secure fabric to the tension wire with hog rings spaced no greater than 24 inches on center.

K. Tension or Stretcher Bars:
1. Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center

L. Tie Wires:
1. Use wire of proper length to firmly secure fabric to line posts and rails.
2. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626.
3. Bend ends of wire to minimize hazard to individuals and clothing.

M. Fasteners:
1. Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
2. Peen ends of bolts or score threads to prevent removal of nuts.

N. Swing Gates:
1. Install swing gates and gateposts per ASTM F567.
2. Direction of swing shall be as indicated on the drawing.
3. Install gates shall be plumb in the closed position having a bottom clearance of 3 inches grade permitting.
4. Hinge and latch offset opening space from the gate frame to the post shall be no greater than 3 inches in the closed position.
5. Double gate drop bar receivers shall be set in a concrete footing minimum 6 inches diameter and 24 inches deep.
6. Gate leaf holdbacks shall be installed for all double gates.

3.04 CLEAN UP

A. Clean up the area of the fence line shall be left neat and free of any debris caused by the installation of the fence.

END OF SECTION

SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Preparation of planting beds.
   2. Excavation for trees, shrubs, and vines.
   3. Planting trees, shrubs, and vines.
   4. Mulching.
   5. Planting ground cover.
   6. Protection, maintenance, repair, and guarantee of plantings.

B. Related Sections:
   1. 31 22 00 “EARTHWORK” for basic subgrade preparation and conservation of onsite topsoil.
   2. 32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS” for furnished / import topsoil, mulches, and soil amendments.

1.02 SUBMITTALS

A. Product information, including but not limited to: <xxxxx>

B. Certifications:
   1. Certificates of inspection as required by governmental authorities.
   2. Manufacturer's or vendors certified analysis for soil amendments and fertilizer materials.
   3. Nursery certifications for plant material, stating botanical and common name.
   4. Any other data substantiating that materials comply with specified requirements.

C. Copies of laboratory results for soil testing.

D. Notice for Design Professional inspection of plants for Acceptance.

E. Written plant maintenance instructions to the Owner, prior to the plant guarantee period.

F. Updated plant maintenance instructions to the Owner, during the Guarantee period.

1.03 QUALITY ASSURANCE

A. The (Sub) Contractor performing landscape work shall be a single firm specializing in landscape work.

B. The (Sub) Contractor performing landscape work shall provide continuous superintendence by an experienced plantsman during the layout, preparation and execution of all landscape work.

C. Pre-Landscape Conference
   1. Prior to the commencement of any landscape work, meet at the site with:
      a. Owner
      b. Design Professional/Landscape Design Professional
      c. Contractor's Project Manager
      d. Contractor's Job Superintendent
      e. (Sub) Contractor and performing landscape work and its Foreman who will be on site full time during the preparation and installation of landscape work.
   2. Review foreseeable methods and procedures related to the landscape work, including but not necessarily limited to the following:
      a. Review project requirements (drawings, specifications, and other contract documents, and in particular landscape work).
      b. Review availability of materials, tradesmen, equipment, and facilities needed to make progress and avoid delays.
      c. Review required inspection, testing, certifying, and accounting procedures.

d. Review regulations concerning code compliance, environmental protection, health, safety and similar considerations.
e. Review required submittals, both completed and yet to be completed.
f. Review soils conditions, soil preparation, installation methods and drainage conditions for landscape work.
g. Review protection and maintenance of landscape work.

3. Record (by the Contractor) the discussions of the conference and the decisions and agreements (or disagreements) reached and furnish a copy of the record to each party attending.

D. Source Quality Control
1. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.
2. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Design Professional, together with proposal for use of equivalent material.
3. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
4. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.
5. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and label with number to assure symmetry in planting.
6. Inspection: The Design Professional may inspect trees and shrubs either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size and quality. Design Professional retains right to further inspect trees and shrubs for size and conditions of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.

1.04 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

B. Trees and Shrubs: Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by Design Professional. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. Do not drop balled and burlapped stock during delivery.

C. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than six (6) hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.

D. Do not remove container grown stock from containers until planting time.

1.05 SITE CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Design Professional for instructions before planting.

C. Coordination with Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Design Professional. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

D. The Design Professional has the right to inspect and approve material or representative samples at the place of growth or any mutually agreed location prior to digging or delivery. Subsequent inspections during installation (with the right of rejection for reasons of disease, damage, or nonconformity) can be anticipated. All plants shall be inspected and approved before they are planted.

1.06 PLANT REPLACEMENT GUARANTEE

A. Guarantee: Replace any plant found by the Design Professional or Owner's Representative to be in an unhealthy condition or not to be thriving during the period of 1 full growing season (April 15 – October 15) year following <Substantial Completion> <Acceptance at no expense to the Owner, provided that the Owner has followed the prescribed maintenance procedures and that no replacements are necessitated by neglect or abuse by the Owner. Disputes arising under this Paragraph shall be referred to the Design Professional for arbitration. The Design Professional's determination shall be final and binding on the parties hereto and may be enforced by the entry of judgment in any court of competent jurisdiction.

B. Replacements shall be made by (weather and seasonal conditions permitting) within 10 calendar days of notification by the Design Professional or Owner's Representative.

C. Materials and Operations: All replacements shall be plants of the same size and kind and as specified in the Plant List and consistent with the sizes of adjacent, thriving plants.

PART 2 - PRODUCTS

2.01 TOPSOIL AND SEEDBED PREPARATION AMENDMENTS

A. Refer to 31 22 00 “EARTHWORK” for conserved onsite topsoil when available. If necessary, amount of topsoil is not present on site, secure topsoil of specified quality from off-site source. Topsoil shall be approved by the Design Professional prior to delivery onsite.

B. Refer to 32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS” for furnished (import) topsoil, lime, water, compost, pre-emergent weed control, and fertilizers.

2.02 AMENDED PLANTING SOIL

A. Amended Planting Soil is made by thoroughly mixing the following: 5 parts topsoil or suitable existing soils. Do not use very poor soil, hardpan or soil injurious to plants. Ensure soil is reasonably clean of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
   1. 1 part composted manure. (32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS”)
   2. 1 part peat moss.
   3. Commercial fertilizer, 5-10-5, at rate of 5 lbs/cu-yd.
   4. Lime at rate of 5 lb/cu-yd.

B. Amended Planting Soil is made by thoroughly mixing the following: 3 parts topsoil or suitable existing soils. Do not use very poor soil, hardpan or soil injurious to plants. Ensure soil is reasonably clean of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
   1. 1 part coarse sand (32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS”)
   2. 1 part peat moss.
   3. Commercial fertilizer, 6-12-12, at rate of 5 lbs/cu-yd.

4. Except for ericaceous plants, add lime to acidic soils having a pH less than 6 to produce a slightly acidic reaction (a pH of 6.0 to 6.5).

C. For tree/shrub planting pit backfill areas, mix Amended Soil prior to backfilling, and stockpile at the site.

D. For planting beds Contractor options to mix Amended Soil:
1. Prior to planting and stockpile at the site.
2. In place. Apply manure, peat, and fertilizer amendments on surface of topsoil/suitable soil and mix thoroughly in-place.

2.03 MULCHES FOR PLANTING BEDS

A. Provide mulches of the types and depths shown, that are clean and free from debris, and reasonably free of weeds, can be distributed uniformly. Mulches may include, but are not limited to:
1. Pine straw (default- mulched planting beds are pine straw unless otherwise shown).
2. Pine bark.
   a. Derived from disease free wood.
   b. Contain no noxious weed seeds, soil, sawdust, or any substance toxic to plant growth.
   c. Be at least 2 years old.
3. Shredded hardwoods.
   a. Contain a maximum of 25% by volume shredded Cypress and shredded shredded pine mulch up to 35% by volume.
   b. Derived from disease free trees.
   c. Particle size less than 1 inch diameter and less than 3 inch length.
   d. Viable weed seeds destroyed by 2 cycles of composting at 140°F and decomposition due to nitrification is complete.
   e. Free from toxic levels of acidity and alkalinity.

2.04 PLANT MATERIALS

A. Quality:
1. Provide trees, shrubs, and other plants of size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock".
2. Plant materials shall be readily adaptable to soil and climatic conditions on the site (from relatively indigenous sources); in natural form of growth, unless otherwise specified; sound, healthy, vigorous and free of insects, insects' eggs, and larvae.

B. Deciduous Trees: Provide trees of height and caliper scheduled or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
1. Provide balled and burlapped (B&B) deciduous trees.
2. Container grown deciduous trees will be acceptable in lieu of balled and burlapped deciduous trees subject to specified limitations of ANSI Z60.1 for container stock.
3. Container grown deciduous shrubs will be acceptable in lieu of balled and burlapped deciduous shrubs subject to specified limitations for container grown stock.

C. Coniferous and Broadleafed Evergreens: Provide evergreens of sizes shown or listed. Dimensions indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad up-right, and columnar. Provide normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown.
1. Provide balled and burlapped (B&B) evergreens.
2. Container grown evergreens will be acceptable subject to specified limitations for container grown stock.

D. The Contractor is responsible for all certificates of inspection of plant materials that may be required by Federal, State or other authorities to accompany shipment of plants.

E. Substitutions are not permitted without written approval. No collected plants other than those shown in the plant list are permitted without written approval.

2.05 GROUND COVER

A. Provide plants established and well-rooted in removable containers or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the pot size shown or listed.

2.06 MISCELLANEOUS LANDSCAPE MATERIALS

A. Anti-Erosion Mulch: Provide clean, seed-free salt hay or threshed straw of wheat, rye, oats or barley.

B. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

C. Filtration/Separation Fabric: Water permeable filtration fabric of fiberglass or polypropylene fabric.

D. Wrapping: Tree-wrap tape not less than 4" wide, designed to prevent bore damage and winter freezing.

E. Stakes and Guys: Provide stakes as detailed of new hardwood, treated softwood, redwood, free of knots holes and any defects. Paint all stakes with flat black enamel paint prior to installation and touch-up paint after installation. Provide wire ties and guy of 2 strand, twisted, pliable galvanized iron wire not lighter than 12 ga. with zinc coated turnbuckles. Provide not less than 1/2" diameter black rubber hose, cut to required lengths and of uniform size to protect tree trunk from damage by wires.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine grading, substrates and conditions where turf and grasses will be established.

B. Do not proceed with permanent grassing installation unless satisfactory conditions exist. Satisfactory conditions include but are not limited to:
   1. Subgrades prepared in accordance with 31 22 00 “EARTHWORK”.
   2. Provide allowances when establishing subgrade elevations for settlement and additions of topsoil, compost, and other soil amendments.
   3. Slopes are stable and are graded to divert any concentrated flow away from slope faces.

3.02 TIME OF PLANTING

A. Optimum planting of trees and shrubs is from October 15th to March 15th unless otherwise specified on the Drawings.

B. At the option and on the full responsibility of the Contractor, planting operations may be conducted outside of the optimum planting season defined by these Specifications, the Plans, published or nursery values for individual plant species, or under unseasonable conditions.

C. Begin planting operations as soon as possible upon completion of other construction within the planting area. Regular maintenance is essential to protect all new plant material.

3.03 PREPARATION

A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Design Professional's acceptance before start of planting work. Make minor adjustments as may be required. No planting except ground covers and vines shall be closer than 2 feet to pavements or structures.

B. Preparation of Planting Beds:

1. If required, loosen subgrade of planting bed areas to a minimum depth of 6 inches using a cultimulcher or similar equipment. Remove stones over 1 inch in any dimension, and sticks, stones, rubbish and other extraneous matter.
2. Prepare planting beds as shown on the Plans. Prepare according to the following areas:
   a. Topsoil and Compost Amendment: Unless otherwise shown, spread 4 inches of screened topsoil and 2 inches of compost and uniformly mix into the top 8 inches of the soil profile. After light rolling and natural settlement the finish surface shall meet grades and elevations shown.
   b. Amended Planting Soil: Unless otherwise shown, spread 4 inches of Amended Planting Soil over loosened subgrade. After light rolling and natural settlement the finish surface shall meet grades and elevations shown.
   c. Amended Planting Soil: Prepare 4 inches total depth of Amended Planting Soil mixture to minimum depth required to meet lines, grades and elevations shown. Place approximately 1/2 of total amount of Amended Planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the Amended Planting soil.
3. Pre-emergent Weed Control: All areas to be planted shall be treated with Scotts Pro Grow Ornamental Herbicide 2 (granular), or approved equal, at the rate of two and a half (2-1/2) pounds per thousand (1000) square feet.

C. Excavation for Trees and Shrubs:
1. Dig planting pits and prepare Amended Planting Soils before plants are delivered to the site.
2. Excavate pits, beds and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation. Diameter of pits for trees is at least 2 feet greater than diameter of the ball or spread of roots.
3. Allow for 4" setting layer of planting soil mixture.
4. For balled and burlapped (B&B trees and shrubs), make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus following allowance for setting ball on a layer of compacted backfill.
5. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.
6. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.
7. Fill excavations for trees and shrubs with water and allow to percolate out before planting.

3.04 PLANTING TREES AND SHRUBS

A. Set balled and burlapped (B&B) stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Face plants to give the best appearance or relationship from existing structures. Remove burlap from sides of balls; retain on bottoms. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3-full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again, after placing final layer of backfill.

B. Set bare rootstock on cushion of planting soil mixture. Spread roots and carefully work backfill around roots by hand and puddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers of soil mixture above roots. Set collar 1" below adjacent finish landscape grades. Spread out roots without tangling or turning up to surface. Cut injured roots clean; do not break.

C. Set container grown stock as specified for balled and burlapped stock, except cut cans on 2 sides with an approved can cutter; remove bottoms of wooden boxes after partial backfilling so as not to damage root balls.

D. Dish top of backfill to allow for mulching.

E. Mulch pits, trenches and planted areas. Provide not less than 3" thickness of mulch, avoiding contact with the tree or shrub, and work into top of backfill and finish level with adjacent finish grades.

F. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage.

G. If deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting.

H. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Design Professional, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character.

I. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

J. Wrap tree trunks of 2" caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures before wrapping.

K. Guy and stake trees immediately after planting, as detailed.

3.05 PLANTING GROUND COVER AND COLOR BEDS

A. Space plants as shown or scheduled.

B. Dig holes large enough to allow for spreading of roots and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.

C. Pre-emergent Weed Control: Treat all shrub and color beds with Ornamental Herbicide (granular) at the rate of 2 ½ pounds per 1,000 square feet, or as recommended by the manufacturer. Provide Design Professional with manufacturers certificate from each bag used. Failure to provide certificates or proof of purchase will be considered "not installed".

D. Mulch areas between ground cover plants, avoiding contact with the plant itself: place not less than 3" thick, unless otherwise shown.

3.06 MULCHES – MULCHED BEDS

A. Unless otherwise shown, apply pine straw at 4” settled depth.

B. Apply compost prior to placing mulch when shown. Apply compost as shown in the plans. If compost application is not detailed:
   1. Apply over planting beds at 2 inches depth and uniformly incorporate into the top 6 to 8 inches of soil.
   2. Apply over mulched planting areas at 2 inches depth as top dressing.

C. Mulched beds: Soak mulch with water immediately prior to or after installation.

3.07 PROTECTION AND MAINTENANCE

A. Provide all plant maintenance immediately after each plant is planted and continue for a period of 1 **full** growing season (April 15th to October 15th) and terminating at Acceptance of the Work by the Design Professional.

B. Maintain all planting and incidentals in good condition and perform all necessary operations for promotion of root growth and plant life. Maintenance of new planting includes, but is not limited to: pruning, watering, cultivation, weeding, mulching, tightening, repairing of guys, resetting plants to proper grades or upright position, restoration of planting saucer, and furnishing and applying such sprays as are necessary to keep the plantings free of insects and diseases.

C. Protect all adjacent site improvements including grass areas during maintenance work and promptly repair any damage.

D. Protect all planting work at all times against trespassing and damages of any kind for the duration of the maintenance period. If any plants become damaged or injured, repair or

replaced as directed by the Design Professional at no additional cost to the Owner. Do not perform any work within, adjacent to, or over any plant or planting area without proper safeguards and protection to the plant material.

E. Water the root system of all plants at sufficient intervals to provide the best conditions for promotion of root growth and plant life.

F. All planting and plant materials required by this contract shall be in satisfactory and acceptable condition when Contractor applies for payment.

G. Sidewalks, streets, and other paved areas shall be kept clean when planting and maintenance operations are in progress.

H. Remove all guys, and stakes from trees at the end of the maintenance period.

I. Prescribed Maintenance Procedures Provide the Owner with written instructions on the proper and subsequent care for the new plant material at the end of his maintenance period.

3.08 INSPECTION, ACCEPTANCE, GUARANTEE AND REPLACEMENT

A. The Design Professional shall inspect all work for acceptance upon written request of the Contractor. Submit request a minimum of 10 days before the anticipated date of inspection.

B. At the sole discretion of the Design Professional and Owner, Acceptance may be granted for sections or lots of the Work.

C. Upon completion of all repairs or replacements which may appear at that time to be necessary in the judgment of the Design Professional, the Design Professional will certify in writing the acceptance of the work.

D. The guarantee period shall begin at Acceptance.

E. All plant materials shall be guaranteed by the Contractor except relocated materials, for a period 90 days for evergreen plants and 30 days after breaking growth in the spring for deciduous plants.

F. Perform periodic inspections, no less than bi-weekly, at no extra cost to the Owner, during the guarantee period to determine what changes, if any, should be made in the Owner's maintenance program. Submit such recommended changes in writing to the Owner and the Design Professional.

G. Replace as soon as weather conditions permit, all dead plants and all plants not in a vigorous thriving condition, as determined by the Design Professional during and at the end of the guarantee period. Thriving plants are free of dead branches and dead branch tips, and bears foliage of a normal density, size, and color. Replacements shall match adjacent specimens of the same species and are subject to all requirements of these Specifications and Plans.

H. Provide all necessary repairs to grades, and lawn areas required due to maintenance or plant replacements.

I. The guarantee of all replacement plants shall extend for an additional period of 90 days for evergreen and 30 days from time of breaking growth in spring for deciduous material after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect subsequent replacement or credit for each item.

3.09 CLEANUP

A. Remove any soil, peat or similar material which has been brought onto adjacent areas by planting operations, maintenance, or guarantee work. All excess soil, stones, and debris which has not previously been cleaned up shall be removed from the site and disposed of in a lawful manner.

B. Upon completion of any maintenance or guarantee work, remove all equipment from the premises to the satisfaction of the Owner.

END OF SECTION

SECTION 32 92 00
TURF & GRASSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Preparation of turf/grass planting areas.
   2. Grass, pasture, wetland, meadow seed mixes.
   3. Sod application.
   4. Hydroseed application.
   5. Protection, maintenance, guarantee.

B. Related Sections:
   1. 31 22 00 “EARTHWORK” for basic subgrade preparation and conservation of onsite topsoil.
   2. 31 25 00 “EROSION AND SEDIMENT CONTROL” for mulches or bonded fiber matrix mulch components to hydroseed mixes.
   3. 32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS” for furnished / import topsoil, mulches, and soil amendments.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Manual for Erosion and Sediment Control in Georgia, 2016 Edition, by the Georgia Soil and Water Conservation Commission, “Best Management Practices”. Apply for permanent and temporary vegetation establishment where noted.

1.03 SUBMITTALS

A. Submit product data for all grassing materials, including, but not limited to:
   1. General disturbed areas hydroseed/mulch mix (state whether cool season or warm season mix)
   2. Meadow mix hydroseed/mulch.
   3. Lime, fertilizer and other soil amendments

B. (Sub) Contractor Qualifications: Submit evidence of qualifications prior to work.

C. Manufacturer’s certificates: for each Sod application (include species).

D. Testing:
   1. Copies of soil lab test results showing recommended amendments and application rates based on specific grass or grass land planting species.

1.04 QUALITY ASSURANCE (not used)

A. (Sub) Contractor Qualifications:
   1. Bonded fiber matrix mulch application Contractor shall be certified by the producer / manufacturer of the bonded fiber matrix material. Provide evidence of Certification to the Design Professional prior to work.
   2. Grassing and lawn maintenance shall be performed by a reputable lawn maintenance contractor. Secure pre-approval of lawn maintenance Contractor by the Design Professional and Owner, prior to any lawn installation commencement

1.05 SITE CONDITIONS

A. Take all necessary precautions in bringing equipment on to and off of the site and protecting curbs, walks, paving, steps, trees & shrubs, and any other existing construction site during hydroseeding and grassing work.

B. Establish grass in all areas disturbed by construction not required to be developed otherwise.

PART 2 - PRODUCTS

2.01 SOD

A. Unless otherwise shown on the Plans, sod is at least 95 percent Bermuda Tifway 419 grass strongly rooted and free of pernicious weeds.

B. Acceptance criteria (sod rolls):
   1. Height of grass in sod rolls is uniform and does not to exceed 3 inches.
   2. Soil is between 1 and 1-1/2 inches thick

2.02 GRASS SEED

A. Provide fresh, clean, new-crop seed complying <with tolerance for purity and germination established by Official Seed Analysts of North America> <with Georgia Seed Laws, Rules and Regulations as follows>.

Germination and hard seed minimum	70%
Purity minimum	90%
Weed seed maximum	2%
Noxious seeds maximum	1% of mix, but not to exceed the specified seeds per lb for each listed noxious weed species in GDOT Standard Spec 890.

2.03 TERMPORARY SEED MIXES

A. Conform to Table 6-4.1 Georgia Erosion and Sediment Control Manual for broadcast rate, for the <"M-L", or "P", or "C"> resource area within Georgia, and for the optimal planting dates for temporary grass seed. Plant the following species in accordance with the Georgia Erosion and Sediment Control Manual:
   1. Sudan grass, Sorghum Sudanese.
      a. Planting rate 60 lbs per acre.
      b. Planting dates April 15-July 31.
   2. Annual Ryegrass, Lolium temulentum.
      a. Planting rate 40 lbs per acre.
      b. Planting dates: Year long except summer season (April 15- July 31), optimal from September 1 – December 31.
   3. Annual Lespedeza, Lespedeza striata.
      a. Planting rate 40 lbs per acre.
      b. Planting dates January 1 – April 15.

2.04 PERMANENT SEED MIXES

A. Conform to Table 6-5.2 Georgia Erosion and Sediment Control Manual for broadcast rate, for the <"M-L", or "P", or "C"> resource area within Georgia, and for the published optimal planting dates for permanent grass seed. Do not plant shrub species or vine species published in Table 6-5.2 unless otherwise shown on the Plans. Unless otherwise specified, plant the following species:
   1. Common Bermuda, Cynodon dactylon
      a. Planting rate 10 lbs per acre.
      b. Planting dates Jan., Feb., Oct., Nov., Dec. for unhulled seeds and when planted with 30 lbs of winter annuals or Tall Fescue.
      c. Planting dates March – June for hulled seeds.
      d. Mowing maintenance height <4> inches.

B. Steep Slope Mix:
   1. Warm season mix applied at a rate of 50 lbs / acre or cool season mix applied at rate of 100 lbs / acre as applicable.
   2. Apply on slopes 2H:1V or steeper.
   3. Mowing maintenance height 6 inches.
   4. Submitted mixes to conform with the following characteristics:
      a. Permanent and temporary seed varieties, season dependent that may include: turf type tall fescue, unhulled Serecia Lespedeza, White Clover, and Bermuda grass.
      b. Min. 5% Durana white clover.
      c. Weed seed, other crop seed < 1.5%.
      d. Coating: Inoculated with Germax Seed Treatment and Myco Advantage, or similar.
   5. Acceptable Products and Manufacturers
      a. Slopemaster mixes from Pennington Seed Inc. Seed Production, Madison GA (seed mix).

C. Wetland / Retention Pond Mix:
   1. Apply where shown at a rate of 12 lbs /acre.
   2. Planting dates March 15-June 1, August 15-October 15.
   3. Submitted mixes to conform with the following:
      a. 25% Redtop.
      b. 25% Virginia Wild Rye.
      c. 15% Fox Sedge.
      d. 10% Woolgrass.
      e. 10% Lurid Sedge.
      f. 5% Joe Pyeweed.

D. Short Native Meadow Mix:
   1. Apply when “Meadow Mix” “Short Meadow Mix”, or “Short Native Meadow Mix” is specified or shown on the Plans.
   2. Apply at rate of 40 lbs /acre, planting dates April 1-June 30.
   3. Submitted mixes to conform with the following:
      a. 40% Little Bluestem.
      b. 30% Blue Fescue or Hard Fescue.
      c. 15% Blue Grama.
      d. 15% Side Oats Grama.
      e. **Do not plant Bermuda grass or other invasive species** at any time within the native planting areas.

E. Tall Native Meadow Mix:
   1. Apply where shown at rate of 40 lbs /acre.
   2. Planting dates March 1-June 15.
   3. Submitted mixes to conform with the following:
      a. 35% Indiangrass.
      b. 20% Little Bluestem.
      c. 20% Switchgrass.
      d. 15% Big Bluestem.
      e. 10% Lovegrass.
      f. **Do not plant Bermuda grass or other invasive species** at any time within the native planting areas.
      g. 25% Big Bluestem, Andropogon Gerardii.
      h. 25% Indian grass, Sorghastrum Nutans.
      i. 25% Little Bluestem, Schizachyrium scoparium.
      j. 8% Switch grass, Panicum vrigatum.
      k. 17% Forbes (such as partridge pea or beggar weed lespedeza).
      l. Weed seed < 1.0%

m. **Do not plant Bermuda grass or other invasive species** at any time within the Meadow mix areas.

F. Meadow and Wildflower Mix:
1. Apply where shown at rate of 40 lbs /acre.
2. Planting dates April 1-June 15, August 15-October 15.
3. Submitted mixes to conform with the following:
a. 30% Blue Fescue.
b. 20% Side Oats Grama.
c. 20% Little Bluestem.
d. 8% Indian Blanket.
e. 5% Lance-leaved Coreopsis.
f. 4% Purple Coneflower.
g. 4% Gayfeather.
h. 3% Chicory.
i. 2% Goldenrod.
j. 1% Joe Pyeweed.
k. 1% Evening Primrose.
l. 1% New England Aster.
m. 1% Black Eyed Susan.

G. Short Meadow and Wildflower Mix:
1. Apply where shown at a rate of Seed mix, 40 lbs per acre.
2. Planting dates April 1-June 15, August 15-October 15.
3. Submitted Mix conforms with the following:
a. 15% Little Bluestem, *Schizachyrium scoparium*.
b. 15% Weeping Lovegrass, *Eragrostis curvula*.
c. 15% Tall Fescue, *Festuca arundinacea*.
d. 10% Durana White Clover.
e. 10% Side Oats Grama, *Bouteloua curtipendula*.
f. 10% Perennial Ryegrass, *Lolium perenne*.
g. 10% Bermuda, *Cynodon dactylon*.5% Birdsfoot Trefoil, *Lotus corniculatus*.
i. 5% Tickseed, *Coreopsis*.
j. 5% Showing Evening Primrose, *Oenothera speciose*.

2.05 HYDROSEED EQUIPMENT

A. Hydroseeding equipment shall have a built-in mechanical agitating system to maintain a homogenous mixture of mulch, seed, lime, and fertilizer for each 150 gallons of water.

2.06 GENERAL HYDROSEED / MULCH MIX

A. Hydroseed / mulch mix components:
1. General seed mixtures as specified or shown on the Plans.
2. Wood cellulose mulch or wood pulp applied at a rate of 2000 lbs/acre. Substitute bonded fiber matrix mulch applied at a rate of 3,500 lbs per acre when specifically shown on the Plans.
3. Fertilizer: Apply nutrients at the ratios and rates as recommended by soil test(s), however in no case exceed 1500 lbs/ac/yr of a 6-12-12 commercial grade.
4. Finely ground fast acting lime (95% passing No. 100 sieve) applied at a rate of 80 lbs/acre if soil pH is less than 5.5, or if no soil analysis is performed.

2.07 NATIVE SEED HYDROSEED / MULCH MIX

A. Hydroseed / mulch mix components for Native seed mixes:
1. Native seed mixtures as specified or shown.
2. Wood cellulose mulch or wood pulp applied at a rate of 2000 lbs/acre. Substitute bonded fiber matrix mulch applied at a rate of 3,500 lbs per acre when specifically shown on the Plans.

3. Fertilizer: Apply Phosphorous (P) and Potassium (K) nutrients at the ratios and rates as recommended by soil test(s), however in no case exceed 1500 lbs/ac/yr of a 0-10-10 commercial grade. **Do not apply Nitrogen to native seed mix areas.**
4. Finely ground fast acting lime (95% passing No. 100 sieve) applied at a rate of 80 lbs/acre if soil pH is less than 5.5, or if no soil analysis is performed.

2.08 STEEP SLOPE HYDROSEED/ MULCH MIX

A. Hydroseed / mulch mix component for steep slope mixes:
1. Steep slope seed mixes as specified or shown.
2. 3500 lbs per acre of hydraulic mulch with Cover Factor (ASTM D7101) ≤ 0.01 (soil loss treated surface / soil loss untreated surface).
3. Fertilizer: 19-19-19 commercial grade applied at a rate of 250 lbs / acre.
4. Lime- fast release at 80 lbs / acre if soil pH is less than 5.5 or if no soil analysis is performed.

B. Acceptable Products and Manufacturers
1. Slopemaster mixes from Pennington Seed Inc. Seed Production, Madison GA (seed mix).
2. Flexterra Flexible Growth Medium Fiber Mulch and Neutra Lime Dry, by Profile Products, Profile Products LLC, Buffalo Grove IL (hydraulic mulch and lime products).

2.09 SEEDBED PREPARATION AMENDMENTS

A. Refer to 31 22 00 “EARTHWORK” for conserved onsite topsoil if available. Refer to 32 05 00 “COMMON WORKS FOR EXTERIOR IMPROVEMENTS” for furnished (import) topsoil, lime, water, compost, fertilizers, mulches for grassing and erosion control.

2.10 WILDFLOWER SEED MIX AND INSTALLATION

A. If wildflower areas are specified or shown conform to GDOT Standard Specification Section 701.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine grading, substrates and conditions where turf and grasses will be established.

B. Do not proceed with permanent grassing installation unless satisfactory conditions exist. Satisfactory conditions include but are not limited to:
1. Subgrades prepared in accordance with 31 22 00 “EARTHWORK”.
2. Provide allowances when establishing subgrade elevations for topsoil and soil amendment installation and settlement.
3. Slopes are stable, do not exceed 2H:1V for Steep Slope areas, and do not exceed 3H:1V for all other areas,
4. Slopes have been graded to divert any concentrated flow away from slope faces.

3.02 TEMPORARY TURF

A. Season: Plant temporary seed mixes at the rates and species, in accordance with the time of year, as shown in Part 2 and on the Plans.

B. Maintain temporary turf until the permanent planting season, at which time the temporary grass shall be mowed down to the ground surface, the area disk harrowed (for conversion to permanent grassing), the soil prepared for the permanent surface as shown on the Plans.

3.03 SEED BED PREPARATION & SOIL TESTING

A. For general areas with removed topsoil or insufficient topsoil and slopes 3H:1V, and flatter:
1. Loosen subgrade as necessary to a depth no less than 4 to 6 inches achieving compaction levels no greater than 80% of standard proctor mixing any topsoil and soil additives into the loosened subgrade.
2. Spread 2 inches of topsoil evenly over disturbed areas and mix along with other initials soil amendments into the loosened subgrade.

3. Do not apply topsoil or compost in a frozen or muddy condition. Provide positive drainage in all cases.

B. For areas where the topsoil **has not been** removed:
1. Scarified, smooth, and remove large sticks, stones (>4") and all rubbish.

C. For general areas, steeper than 3H:1V
1. Loosen soil to a practical depth by scarifying, plowing as practical, dragging a spiked chain, walk the surface with cleated equipment or if shown by making serrated cuts. Spread 2" of topsoil starting at the top of slope only if the surface is prepared with serrated cuts.

D. Perform soil test of the upper 4 to 6 inches of mixed subgrade and topsoil to determine application rates of lime, fertilizer, and other amendments. Soil tests may be performed by County extension offices, University laboratories or other laboratories mutually agreed by the Design Professional and Contractor.

E. Apply 1 ton of lime per acre to seedbed, or as otherwise needed to increase pH to between 6.0 and 6.5.

F. Apply any additional fertilizer than shown or proposed in the hydroseed mix at the recommended rates for grassing areas as determined by a soil analysis not to exceed 1500 lbs per acre per year of 6-12-12 fertilizer. **Except that for the native grass mixes, do not apply Nitrogen fertilizers - only apply phosphorous or potassium if deficient** and no more than 1500 lbs per acre per year of 0-10-10 fertilizer**.**

G. Scarify or till soil to a depth of 6 inches, mixing any lime, fertilizer, and other amendments.

H. Remove sticks, stones and rubbish from surface.

I. Perform finish grading to achieve smooth contours and meet finish grades shown on the Plans, with allowances made for settlement and sod thickness where applicable. Finish surface textures as follows:
1. Smooth the final surface on areas 4H:1V or flatter.
2. Provide surface grooves with a tracked vehicle on slopes exceeding 4H:1V. Surface grooves are perpendicular to the fall line of the slope.

3.04 ADDITIONAL PREPARATION FOR TURF AREAS INCLUDING: SOD AREAS, IRRIGATED GRASSING AREAS, GRASS PLAY AREAS

Spread 1 inch of nutrient grade compost and an additional 3 inches of topsoil, for 4 inches min. total depth of topsoil> on loosened subgrade and prior to performing soil tests.

A. Contractor option to blend topsoil, compost, and other soil amendments prior to spreading on loosened subgrade at onsite or offsite location if approved by the Design Professional and if blending is observed by Design Professional or Testing Agency.

B. Remove all stones, sticks and rubbish over 1.0" by hand raking or by a rockhound attachment.

3.05 SODDING

A. Lay sod by butting the ends and sides up evenly and staggering the rolls of sod. Do not overlap sod.

B. As soon as the sod is laid or as it is being laid, roll over it with a light roller, ensure all of the sod is in contact with the soil. The completed sodded areas shall be true to finish grade, even and firm at all points.

C. Commence watering within 4 hours of placement.

3.06 SEEDING AND MULCHING

A. Apply seed and mulch to smoothed finish grade surface at the rates specified in Part 2. Permanent planting dates shall be approved by the Design Professional and conform to Part 2 for individual mixes.

B. Comply with manufacturer recommendations for hydroseed/ mulch mixtures, generally install in a 2 step process.

1. Step 1- apply seed, amendments, and small amount of mulch for visual metering of areas to be vegetated. Apply seed and amendments at the specified rates.
2. Step 2- Immediately mix and apply the remaining mulch and growing media and applying in opposing directions to achieve total specified mulch rate per are and with complete coverage. Remove any mulch slurry sprayed onto any hardscape surface or non-grass planting bed.

C. Any areas not specifically called out as sod shall be hydroseeded unless otherwise specified.

3.07 GENERAL MAINTENANCE, PROTECTION, GUARANTEE

A. Protect and maintain all grass areas by watering, mowing as necessary, replanting, and overseeding to establish a uniform stand. Reseed if satisfactory initial growth does not occur within 18 days of planting.

B. Maintain through acceptance by Owner and a minimum of 60 days after material completion of the project.

C. Provide frequent light irrigation if no natural rain events during the first 2 weeks of seeding to prevent the top of the soil from drying out.

D. After seed germination and when grass is about 1 inch tall, reduce irrigation frequency and increase volume as necessary to maintain growth and establish root zone.

E. Repair all seed washing and erosion.

F. Apply maintenance fertilization each subsequent growing season as required based on recommended rate from soil analysis and based on plant species needs.

G. Maintain grass height as recommended in Part 2 seed mixtures or as indicated in other Part 3 articles.

3.08 MAINTENANCE FOR TURF AREAS (SOD, IRRIGATED GRASS, PLAY AREAS)

A. Repair bare spots and re-fertilize and lime the soil based on soil analysis of failed areas. Replant if satisfactory initial growth does not occur within 18 days of planting. Scattered bare spots less than 1 square foot are acceptable when accounting for no more than 3% of the total area.

B. For sod, irrigated turf areas, play turf areas apply 300 lbs per acre of ammonium nitrate when turf is 2 inches high. Do not apply nitrogen between October 15 and March 15.

C. For sod areas, apply 2 topdressing applications of coarse sand and peat moss (75% sand and 25% peat) at 6 mo. intervals>

3.09 MAINTENANCE FOR NATIVE OR NATIVE MEADOW MIX GRASS MIX AREAS

Reseed and water areas that do not show satisfactory growth within 45 days of planting.

A. Native mix areas shall be fully established at the end of the 2nd growing season with grass heights over 1.5 feet and scattered bare spots with no vegetation are limited to no more than 4 square feet in size account for no more than 10% of the total area.

B. Do not provide general mowing during the first 2 growing seasons. Provide only spot treatments of mowing, applications of an appropriate herbicide or mechanical removal as required to control weeds and invasive plants that would interfere with establishment of the native mix.

C. Long Term Maintenance:
1. After native or native meadow mixes are established- mow to a height of 6-12” height, when dormant, on a 3 year rotation. Do not mow, disc, or burn more than 1/3 of an established area in any one year period.
2. Continue spot removal or control of invasive vegetation as needed each growing season. Remove such vegetation prior to it going to seed.

D. Long Term Maintenance:

1. After native or native meadow mixes are established mow to a height of 6-12” height each year, late fall or winter, after seed heads have dried and plants are dormant.
2. Continue spot removal or control of invasive vegetation as needed each growing season. Remove such vegetation prior to it going to seed.

E. Contractor to provide maintenance on native or native meadow mix grass areas through the end of the 2nd growing season on no more frequently than a monthly basis.

3.10 CLEAN UP

A. Remove any soil, mulch or similar material which has been brought onto paved areas. Upon completion of the planting, remove all excess soil, stones, and debris which has not previously been cleaned up as directed by the Design Professional.

END OF SECTION

SECTION 33 11 00
WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Water distribution system (domestic and fire protection) pipes, fittings, and appurtenances.
   2. Coordination with local authorities and utility providers.
   3. Pressure testing and sterilization.

B. Related Sections:
   1. 31 22 00 “EARTHWORK” for trench excavation, backfill, and compaction.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Comply with Rome-Floyd County Water Main Standards for domestic water line systems, meters, and backflow prevention devices.

B. Comply with Rome-Floyd County requirements and NFPA 24, Outside Protection, latest edition, for fire line systems, fire hydrants and related fire protection system

1.03 SUBMITTALS

A. Product data: For each type of piping material, prefabricated structure, and casting. Indicate product descriptions and installation procedures.

B. As-builts: Provide the Owner with one (1) copy of a reproducible "as-built" plan of all underground utilities showing the location of each with dimensions shown to the building and/or curb line from each underground utility.

C. Certification(s) of pressure testing.

D. Certification(s) of disinfection of all potable water piping.

1.04 QUALITY ASSURANCE

A. Underground piping which is used for fire protection shall be installed by a Contractor which holds a current Georgia Certificate of Competency for Automatic Fire Sprinkler Systems.

1.05 SITE CONDITIONS

A. Consult with the local governing authority prior to formulating bid to coordinate timing of on-site water improvements with off-site water line improvements.

B. Obtain all necessary permits for work within public right-of-way.

C. It is the Contractor's responsibility to determine all requirements of the local Water Department regarding new utility service to the site. The installation shall be in complete accordance with those requirements. Notify the local authority prior to backfilling any buried or concealed plumbing and allow inspection and observation of all Work.

D. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, Georgia, and federal authorities having jurisdiction.

E. Coordinate water distribution system installation with grading and paving and other site operations.

F. Install water mains when subgrade is within 6 inches of final grade, and prior to paving base installation.

1.06 WARRANTY

A. Contractor shall warranty the construction and workmanship of water distribution system(s) for a period of one (1) year from the date of project Acceptance.

PART 2 - PRODUCTS

2.01 DOMESTIC PIPING MATERIAL

A. Pipe material, unless otherwise provided shall conform to the following:
   1. 3” and smaller domestic water service pipe installed underground shall be Type "K" hard drawn copper tubing with wrought copper solder joint fittings conforming to ASTM B-88-72. Minimum depth of cover is 36" or as required by local authorities or utility provider.
   2. 4” and larger domestic water pipe installed underground shall be cement lined ductile iron pipe conforming to ANSI A21.51. Minimum depth of cover is 36".
   3. Install warning tapes with metallic cores 12" above all underground piping. Unless otherwise provided, warning tape shall be Brady 91603(blue) for water lines, 91604(green) for sanitary sewer lines and 91600(yellow) for gas lines or approved equal by Seton or T&B Westline. Warning tape shall rise out of the ground and be accessible at the building wall or other outside location.

B. Pipe joints, unless otherwise provided shall conform to the following:
   1. Joints in copper pipe shall be made with lead free solder containing tin-copper-silver or 95-5 tin antimony.
   2. In lieu of soldered fittings in copper pipe, the contractor may substitute Victaulic or Grinnell Gruvlok groved mechanical couplings or T-Drill mechanically formed fittings with brazed connections. Each of these systems shall be used in accordance with the manufacturer’s published instructions.
   3. Joints in ductile iron water and sewer pipe shall be Tyton joints except that joints at fittings in water lines shall be bolted mechanical joints.
   4. Connections of copper pipe to ferrous pipe and/or equipment shall be made with dielectric unions, Watts series 3000, Victaulic or Gruvlok Clearflow or approved equal.

C. Valves, unless otherwise provided shall conform to the following:
   1. Unless specifically indicated otherwise, the valves shall be designed for not less than 125 pounds working pressure. The valves shall be suitable for the service for which they are installed.
   2. Gate valves for copper water lines shall be Milwaukee Fig. 115 bronze valve with non-rising stem (nut and valve key) and sweat ends or approved equal by Crane, Hammond, Mueller, Nibco, Stockham or Watts.
   3. Gate valves for ductile iron water lines shall be Watts model 406-NRS-RW flanged gate valve with non-rising stem (nut and valve key) or approved equal by Crane, Hammond, Kitz, Milwaukee, Mueller, Nibco, or Stockham.
   4. Double check valves shall be Watts No. 709-RW or 007-QT as indicated, epoxy coated double check valve with two gate valves and four test cocks. The valve assembly shall be U. L. listed. Approved equal valves by Ames, Febco, Hersey or Wilkins are acceptable.

2.02 FIRE PROTECTION PIPING MATERIAL

A. Valves
   1. OS & Y valves, post indicator valves and check valves shall be listed by U. L. for use in fire mains. Gate valves: Iron-Body Bronze - Mounted Gate Valves, Sizes 3" - 12", inclusive: Order Specification: Double-Disc, Parallel Seats, Non-rising stem (IS), Rated at 200-psi WWP, O-ring seals, Std 2" square wrench nut, and conforming to AWWA Specifications C500 in all respects. Check with Water Department for direction of opening.
   2. Post indicator valve: include a compatible supervisory control switch with tamper proof cover per manufacturer recommendations. Route all necessary conductors in approved conduit.

B. Underground Piping – Ductile Iron
   1. Underground piping shall be cement lined ductile iron pipe manufactured in accordance with ANSI 21.51.
   2. Joints in ductile iron water pipe shall be Tyton joints except that joints at fittings shall be bolted mechanical joints.

C. Fittings And Couplings (Underground Piping)
   1. Fitting for underground piping shall be ductile iron manufactured in accordance with ANSI A21-10. All ductile iron pipe fittings shall be in accordance with AWWA C151/ANSI A21.51.

D. Backflow Prevention Valves
   1. Double check detector valve assembly shall be Watts 709 DCDA double check valve with detector CFM meter, two OS & Y gate valves and four test cocks.
   2. Valves shall have epoxy coated cast iron bodies. The valve assembly shall be U. L. listed.
   3. Valves shall be as manufactured by Watts or approved equal by Ames, Febco or Hersey.

E. Fire Hydrants
   1. Fire hydrants shall be an AWWA listed type having two 2-1/2" hose outlets and a 4-1/2" pumper outlet with threads compatible with Local Fire Department equipment.

PART 3 - EXECUTION

3.01 GENERAL

A. Permits: Obtain the necessary permits from local governing authorities having jurisdiction and from related utility providers prior to performing any water work on site.

B. Line and Grade: Layout water systems to the required lines and grades; with fittings, valves and hydrants at the required locations; and with joints centered and spigots home; and with all valve and hydrant stems plumb.

C. Protecting underground and surface structures: Provide temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work.

D. Sub-surface exploration: Examine all available records and make explorations and excavations necessary to determine the location of existing pipes, valves, or other underground structures.

E. Detectable wire: Install tracing wire with all non-metallic piping.

3.02 LAYING PIPE

A. Install underground fire protection piping in accordance with NFPA 24-8-1 through 8-7. Anchor all tees, plugs, caps and bends with clamps, tie rods and concrete thrust blocks in accordance with NFPA 24-8-6. Underground fire protection piping shall have a minimum of 48 inches of cover above the top of the pipe.

B. General: Before lowering pipe into trenches, grade the bottom of the ditch so that will have a bearing for its entire length. Carefully examine the pipe for defects and clean the inside. After placing pipe in ditch, clean the bell gasket, and spigot of all dirt, sand and foreign material. Apply a thin film of lubricant to the gasket and spigot. Insert the plain ends of the pipe into the socket after until it makes contact with the bottom of the socket.

C. Trench water: Close the open end of pipe by approved means at all times when pipe laying is not in progress such that no trench water is permitted to enter the pipe.

D. Cutting pipe: Cut pipe in a neat and workmanlike manner for inserting valves, fittings or closure pieces.

E. Direction of laying: Unless otherwise recommended by the manufacturer or local authorities having jurisdiction, lay pipe with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall face upgrade.

F. Permissible deflection: Wherever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions, to plumb stems, or where long radius curves are permitted, the degree of deflection is the lesser as recommended by the manufacturer of the pipe and the maximum allowed by local authorities having jurisdiction.

G. Unsuitable conditions: Do not lay pipe in water or when the trench conditions or weather is unsuitable for such work, except by written permission of the Design Professional.

3.03 DUCTILE IRON PIPE - PUSH ON JOINTS

A. Joints shall be made by means of a compression-type, push-on resilient gasket. Lubricate gaskets before installation using as recommended by the pipe manufacturer. Identify the seated joint by the visible mark on the spigot of the installed pipe section. When the temperature is above 60 degrees F., force the spigot end of each cast iron pipe lead tightly on the bell of the preceding pipe. When the temperature is below 60 degrees F., maintain 1/16 inch clearance from the spigot end of pipe to face of the bell for expansion.

B. Assemble, handle and install flexible joint pipe in accordance with the printed manufacturer recommendations.

3.04 SETTING APPURTENANCES

A. Valves and fittings: Set and join gate valves and pipe fittings to new pipe in the manner previously specified for cleaning, laying and jointing pipe and as recommended by the manufacturer.

B. Valve boxes: Firmly support cast iron valve boxes, positioned centered and plumb over the wrench nut of the gate valve, with box cover flush with the surface of the finished pavement or at such other level as may be directed.

3.05 SETTING HYDRANTS

A. General locations: locate hydrants to provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians.

B. Cleaning: Thoroughly clean hydrants of dirt or foreign matter before setting.

C. Position of nozzles: Install hydrants plumb with nozzles at an angle of 45 degrees with respect to the curb with nozzles at least 18 inches above the ground.

D. Drainage at hydrant: Wherever hydrants are set in impervious soil, excavate a drainage pit below each hydrant and filled and compacted with coarse gravel or broken stone mixed with coarse sand, under and around the bowel of the hydrant and to a level 6 inches above the waste opening.

3.06 ANCHORAGE OF BENDS, TEES, AND PLUGS

A. Limiting pipe diameter and degree of bend: Apply reaction or thrust blocking/backing on all pipe lines at all tees, plugs caps and at bends deflecting eleven degrees or more. If approved, in lieu of blocking, movement may be prevented by attaching suitable metal rods or straps.

B. Reaction backing: Reaction or thrust backing shall be of concrete. Place between solid, unexcavated ground and the fitting to be anchored; the area of bearing on pipe and on ground in each instance shall be as shown on the drawings. Place the backing, unless otherwise shown, so that the pipe and fittings' joints will be accessible for repairs.

3.07 TESTING- QUALITY ACCEPTANCE

A. FLUSHING OF SYSTEM

1. Thoroughly flush underground piping in accordance with NFPA 24-8-8 prior to the connection of inside piping.

B. HYDROSTATIC TESTS

1. Pressure during test: After the pipe has been laid and partially backfilled as specified, all newly laid pipe, or any valved section of it, shall, unless otherwise specified, be subjected to hydrostatic pressure of 200 psi for at least 3 hours in accordance with NFPA 24-9.2.
2. Procedure: Test shall conform with AWWA C600. Fill each section of pipe slowly with water. Apply the specified test pressure, measured at the lowest point of elevation, by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection gauges and all necessary apparatus shall be furnished by the Contractor. Perform the test separately to each valved section in order to check leakage through all valves. Contractor shall notify and request Fire Marshal to monitor all pressure test and leakage test procedures.

3. Expelling air before test: Before applying the specified test pressure, expel all air from the pipe. To accomplish this, tap if necessary, at points of highest elevation, and afterwards plug tightly.
4. Leakage defined: Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled. Fire Marshal to monitor leakage test.
5. Permissible leakage: Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage under normal operating pressure. No pipe installation will be accepted until or unless this leakage is less than 10 U.S. Gal. per 24 hours per mile per inch nominal diameter. In calculating leakage, the Fire Marshal will make allowance for added joints in the pipeline above those incidental to normal unit lengths of pipe.
6. Variation from permissible leakage: Should any test of combined sections of pipe laid disclosed leakage per mile of pipe greater than that specified, or if individual sections show leakage greater than the specified limit, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.
7. Time for making test: Pipe may be subjected to hydrostatic pressure, inspected, and tested for leakage at any convenient time to Contractor, Design Professional and Fire Marshal after partial completion of backfill. Provide water as necessary to make the tests when each section is ready.
8. Certification: Complete and submit the joint Owner-Contractor inspection and test certificates in accordance with NFPA –24-A-9-2.1 to the Fire Marshall, Owner, Design Professional, and water system authority.

C. STERILIZATION
1. Before being placed in service, chlorinate all new water main pipe lines and accessories. Furnish all chlorinating equipment and materials, labor and supplies. Prior to chlorination, remove all dirt and foreign matter by a thorough flushing through the hydrants or by other approved means. Flush each valved section of new laid pipe independently prior to the pressure test and before the trench has been backfilled. All flushing, chlorinating and testing of water main pipe lines shall be in strict compliance with the Utility Owner.
2. Sterilize in accordance with AWWA C601. Sterilize by applying clear water containing a minimum of 50 ppm of available chlorine. The chlorine bearing water shall remain in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period, the chlorine residual in all units and at extremities of pipelines shall be at least 25 ppm. The Contractor to coordinate and schedule the testing of treated water through the Owner's Representative and Water Utility.
3. Chlorinating valves and hydrants: Operate all valves or other appurtenances while the pipeline is filled with the chlorinated agent.
4. Final flushing and test: Following chlorination, thoroughly flush all treated water from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be approved by the water utility owner.
5. Repetition of procedure: Should the initial treatment prove ineffective, repeat the chlorination procedure until confirmed tests shown that water sample conforms to the requirements previously stated.

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes :
   1. Storm sewers, storm structures, appurtenances.

B. Related Sections:
   1. 31 00 01 “SITE PREPARATION AND GENERAL SITE WORK” for layout and construction staking.
   2. 31 22 00 “EARTHWORK” for trench excavation; trench safety; pipe bedding, backfill and compaction.

1.02 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Georgia Department of Transportation (GDOT)
   1. Department of Transportation, State of Georgia Standard Specifications, Construction of Roads and Bridges, 2013 Edition. Unless otherwise noted, conform with GDOT Standard Specifications for work and materials for storm drain utilities. In the event of conflict apply the more stringent requirement.

B. American Association of State Highway and Transportation Officials (ASHTO)
   1. AASHTO M36 – Standard specification for Corrugated Steel Pipe, Metallic-Coated, for Sewer and Drains.
   2. AASHTO M190 – Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
   3. AASHTO M170 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

C. American Society of Testing Materials (ASTM)
   1. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity – Flow Applications.

1.03 SUBMITTALS

A. Product information including manufacturer instructions: pipe, fittings. Submit for approval prior to delivery of any material.

B. Shop Drawings:
   1. Structures. Submit for approval prior to delivery of any material.
   2. CMP Underground systems, as applicable. Indicate all materials to be furnished, material standards, and design assumptions for structural analysis. Note all proposed deviations or alternatives from the site layout plans, include the compliance of applicable ASTM or AASHTO specifications for all deviations.

C. Record Drawings: At project closeout, submit record drawings of installed site drainage piping (including lengths and slopes), underground systems as applicable, layout, inverts, top elevations, and products. As-built record drawings shall be prepared by a land surveyor licensed in the State of Georgia. Revisions or necessary approved field changes shall be flagged.

1.04 SITE CONDITIONS

A. Keep a hard copy of GDOT Standard Specifications for reference at the job site at all times during construction.

B. Comply with all applicable codes and ordinances of local authority.

C. Clean all existing drainage systems which are tied into the work.

D. Where applicable, engineering design and manufacturer of underground detention systems shall be by an established company with demonstrated experience in successful completion of

a minimum of 5 similar underground systems and has been regularly performing such work for a minimum of 5 years.

E. Maintain in operating condition all existing surface or subsurface utilities storm drainage systems in accordance with 32 40 00 DEMOLITION AND STRUCTURE MOVING. Repair any damage done to existing utilities during the course of the work, due to construction.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

A. Concrete Pipe: Unless otherwise shown, concrete pipe shall be reinforced Class IV (ASTM C76, AASHTO M170) with bell and spigot joints with rubber gasket per ASTM C433.

B. Corrugated Metal Pipe (CMP or AST2): Unless otherwise shown, CMP / AST2 is as follows: Material / Coating: Aluminized Steel Type 2 (AST2) per AASHTO M274 or ASTM A929.
   1. Corrugation Type: Corrugations per AASHTO M36, Type 1 (circular). Corrugations are either ½" deep or 1" deep depending on diameter in the tables below.
   2. 2-2/3" x 1/2" corrugations: minimum pipe gauges by pipe diameter.

14 Gauge Pipe Diameters	**12 Gauge Pipe Diameters**
15" 18" 24" 30" 36"	42" 48" 54" 60"

   3. 3" x 1" corrugations: minimum pipe gauges by pipe diameter.

12 Gauge Pipe Diameters	**10 Gauge Pipe Diameters**
60"-96"	78"-144"

C. Spiral Rib Corrugated Metal Pipe: Unless otherwise shown, spiral rib CMP or spiral rib AST2 pipe is as follows.
   1. Material / Coating: Aluminized steel Type 2 (AST2) per AASHTO M274 or ASTM A929.
   2. Corrugation Type: Spiral rib corrugated per AASHTO M36, Type 1R (circular-spiral rib), ¾" corrugations. The spiral rib pipe shall have a documented design manning's n of 0.012 from pipe manufacturer.
   3. Minimum pipe gauges by pipe diameter:

14 Gauge Pipe Diameters	**12 Gauge Pipe Diameters**	**10 Gauge Pipe Diameters**
18" 24" 30" 36" 42"	54" 60" 72" 84"	90" 96" 102" 108"

D. Unless otherwise shown, downspout and roof rain leader pipe shall be schedule 40 polyvinylchloride pipe with matching solvent welded fittings.

E. High Density Polyethylene (HDPE) corrugated pipe and fittings: Unless otherwise shown, conform with the following:
   1. For 4 to 10 inch diameters, smooth interior and annular exterior corrugated HDPE Pipe per AASHTO M252, Type S.
   2. For 12 to 48 inch diameters, smooth interior and annular exterior corrugated HDPE Pipe per AASHTO M294, Type S.
   3. For 54 to 60 inch diameters, smooth interior and annular exterior corrugated HDPE Pipe per AASHTO MP7-97, Type S.

F. Pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. Joints shall meet or exceed the “soil tight” joint performance criteria of AASHTO Standard Specifications for Highway Bridges, Division II.

2.02 CMP UNDERGROUND DETENTION SYSTEM

A. Unless otherwise shown, CMP pipe shall be aluminized steel type II per AASHTO M274 or ASTM C929. Corrugations and pipe type are in accordance with AASHTO M36.

B. Pipe size, gauge and corrugations are shown on plans. Barrel spacing, number of barrels, stone base thickness are shown on the plans.

C. Manhole access, minimum 24” diameter shall be provided to allow access to system.

D. Pipe joints:
   1. Minimum joint spacing is 10 ft.
   2. Performance requirements = soil tight, gravity flow joints per AASHTO M36 and ASTM A760.
   3. Do not overlap pipes and utilize banding consistent with the pipe of type being joined.

E. Integral End Sections:
   1. Each barrel of the CMP system shall 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 are not permitted.
   2. Unless otherwise approved by the design professional, bulkheads/end sections and fittings shall be fabricated prior to delivery on site.

2.03 CLEANOUTS

A. Unless otherwise provided on the plans, cleanouts where shown shall meet the following:
   1. Cast iron cleanout flush with finish grade with a countersunk brass plug.
   2. Center the cleanout in a 4 inch depth concrete pad. Minimum size of concrete pad shall be sufficient to provide 6” of clearance from the edge of cleanout to the edge of concrete, but shall not be less than 18” x 18”. Construct the concrete pad with a 1/4” to 3/8” radius rounded edge.

2.04 APPURTENANCES MATERIAL

A. Concrete shall have a minimum compressive strength of 3,000 psi.

B. Mortar for masonry work in storm sewer structures shall be 1:2 cement sand mix. Cement shall be High Early Strength American Portland cement. Sand shall be clean and sharp, free from all deleterious substances and shall contain not more than 5% by volume of material passing No. 100 sieve.

C. Brick shall be clay or shale Hard No. 1 building brick.

D. Castings: All castings shall be gray iron per Georgia DOT Specifications. Casting, grates, frames and other storm drainage appurtenances shall be on site prior to storm drainage installation. Maintain a snug fit between grates, lids, etc., and frame. All castings shall be heavy-duty, bicycle safe type.

E. Other materials required to completely install storm sewers in accordance with these specifications shall conform to all applicable articles and paragraphs of Georgia DOT Specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify lines, grades, and construction stakes before commencing any excavation for storm drainage pipes or structures.

3.02 EXCAVATION

A. Perform trench and structure excavation in accordance with 31 25 00 “Grading” and in accordance with all OSHA Excavation Standards.

3.03 PIPE BEDDING

A. Unless otherwise shown on the Drawings, construct all bedding in accordance with 31 25 00 “Grading”. Where incompressible soils or rock are encountered, excavate in accordance with 31 25 00 “GRADING”.

3.04 CONCRETE PIPE INSTALL

A. Concrete pipe: lay section in a prepared trench with socket ends pointing upstream. Join sections, including rubber gaskets in accordance with manufacturer recommendations.
   1. Install concrete anti-seep collars at all pipe joints for reinforced concrete pipe **within the limits of the stormwater management facility dike**. Concrete anti-seep collars shall meet the following:
      a. Extend 12 inches, minimum, beyond the outer dimension of the pipe in each direction.
      b. Minimum 12 inches in thickness measured parallel to the concrete pipe.
      c. Reinforced with No. 3 bars at perimeter of concrete anti-seep collar. Maintain 2 inches clearance from outer dimension of anti-seep collar.

3.05 CORRUGATED METAL PIPE AND PIPE ARCH INSTALLATION

A. CMP and pipe arches: lay sections in prepared trench, with outside laps of circumferential joints pointing upstream and longitudinal joints at the sides. Join the sections with coupling bands, fastened by 2 or more bolts. Before backfilling repair any damaged coating or exposed base metal.

3.06 HDPE AND PVC PIPE INSTALLATION

A. Install in accordance with ASTM D 2321.

3.07 CMP UNDERGROUND DETENTION SYSTEM

A. Install CMP in accordance with manufacturer’s recommendations and ASTM A798.

B. For operation of temporary construction vehicles over the CMP system provide temporary cover of compacted gravel over the top of pipe as follows:

Minimum Cover (ft) Requirements

Pipe Span	Axle Loads (kips)			
(inches)	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

C. Unless otherwise specified, place backfill material in 8 inch loose lift and compact to 90% of maximum density (per standard proctor).

3.08 APPURTENANCES

A. Headwalls and aprons shall conform with the Plans.

B. Curb Inlets, Weir Inlet, Drop Inlets, and Manholes: Refer to plans for location and type.

C. Connect all downspout and rain leader lines to storm drainage system as shown.

D. Line Tracers: Wrap all non-metallic pipes with metallic tracer tape prior to backfill.

E. Line Markers: During back filling of site drainage systems, install continuous underground-type plastic line marker, located directly over buried line at 6” to 8” below finished grade.

F. All joints between pre-cast base, risers, and round-2-square adapters shall be keyed. All joints shall be grouted inside and out.

G. Stormwater Quality Control Devices (when applicable) shall be installed as recommended by the manufacturer.

H. Leave 2” diameter PVC temporary opening at subgrade in drainage structures for surface drainage. Opening shall be grouted up after finish grading and paving is completed. Contractor shall provide for temporary surface drainage removal to allow timely construction.

3.09 BACKFILLING

A. Check vertical and horizontal alignment of the pipe, culvert, or storm drain by sighting along the crown, invert, and sides of pipe. Check for sagging, faulting, and invert heaving. Repair any issues before backfilling pipe.

B. Backfill in accordance with 31 22 00 “EARTHWORK”.

3.10 VIDEO INSPECTION

A. Video surveillance may be conducted by the Owner on storm drain installations after completion of all activities that may damage the pipe but prior to the placement of the base and paving when applicable. If video surveillance indicates problems such as pipe deformation, cracking, or joint separation, the Contractor shall be responsible for repairing or replacing these pipes at no cost to the Owner.

3.11 TESTING- QUALITY ACCEPTANCE

A. Perform compaction testing in accordance with 31 22 00 “EARTHWORK”.

B. A minimum of 25% of the installed length of smooth lined corrugated polyethylene (PE), High Density Polyethylene (HDPE) or PVC pipe, selected by the Design Professional, shall be tested for deformation by the Contractor using a nine-point mandrel.
   1. The mandrel shall have an effective diameter equal to 95% of the base inside diameter.
   2. Provide the Design Professional with a proving-ring to verify mandrel size.
   3. Smooth lined corrugated polyethylene or PVC profile wall drain pipe installations shall have a maximum of 5% deflection when checked after completion of all construction activities that may damage the pipe but prior to placement of the base and paving when applicable.
   4. If mandrel testing indicates that problems exist, the Design Professional may determine that up to 100% of the storm drain installation be checked for deformation.
   5. Pipe with over 5% deflection shall be removed and replaced at no cost to the Owner.

3.12 MAINTENANCE AND PROTECTION

A. Before any traffic over a culvert is allowed, provide an adequate depth and width of compacted backfill to protect the structure from damage or displacement. Any damage or displacement that may occur after installing and backfilling shall be repaired or corrected at the Contractor’s expense.

B. Remove any debris or silt that constricts the flow through a pipe as often as necessary to maintain drainage throughout the life of the Contract.

3.13 CLEANUP

A. Upon completion of work, all forms, equipment, protective covering, and rubbish resulting therefrom shall be removed from the premises.

B. Carefully clean all pipes, culverts, structures, and appurtenances of dirt, rubbish, and surplus mortar before the work is accepted.

END OF SECTION