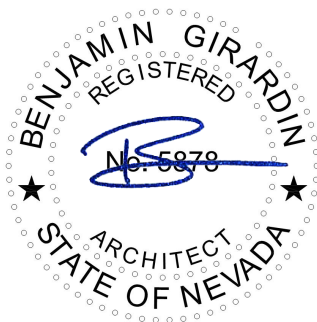


Project Manual Specifications UNLV Police Headquarters Interior Improvements Construction Document



1280 Dorothy Ave
Las Vegas, Nevada





Project Manual

UNLV Police Headquarters

Las Vegas, Nevada

10 Nine Project Number:

217-0019

UNLV Contract Number:

7032

Date:

January 26, 2018

Owner

UNLV / NSHE
2601 Enterprise Road
Reno, NV 89512

Architect

10 Nine Design Group
801 Las Vegas Blvd S #150
Las Vegas, NV 89101
(702) 835-7001

TABLE OF CONTENTS

NOTICE (2 Pages)

EXHIBIT E - INSURANCE REQUIREMENTS (2 Pages)

DIVISION 1 - GENERAL REQUIREMENTS

01016	Contractors Use of Premises
01020	Allowances
01041	Project Coordination
01090	Reference Standards
01300	Submittals
01400	Quality Control
01410	Testing Laboratory Services
01500	Construction Facilities and Temporary Controls
01600	Material and Equipment
01700	Cleaning, Adjustments, & Systems Demonstrations

DIVISION 2 - SITE WORK

02200	Excavation, Backfilling and Compacting
02900	Landscaping & Sprinkler Irrigation Systems Repair

DIVISION 3 - CONCRETE

03100	Concrete Formwork
03210	Reinforcing Steel
03300	Cast-in-Place Concrete

DIVISION 4 - MASONRY

04731	Quartz Surface Fabrications
-------	-----------------------------

DIVISION 5 - METAL

05720	Handrail
-------	----------

DIVISION 6 - WOOD AND PLASTICS

06050	Framing Carpentry
06200	Finish Carpentry
06410	Cabinets
06650	Cultured Marble
06651	Solid Surface Fabrication

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07141	Cold Fluid – Applied Waterproofing
07210	Insulation
07610	Metal Roofing
07900	Joint Sealants

DIVISION 8 - DOORS AND WINDOWS

08100	Steel Doors and Frames
08200	Wood Doors
08260	Bullet Resistant Doors
08710	Door Hardware
08900	Bullet Resistant Glass
08960	Impact Protective Film

DIVISION 9 - FINISHES

09260	Gypsum Board
09300	Tile Floor
09687	Carpet
09900	Painting

DIVISION 10 - SPECIALTIES

10260	Bullet Resistant Panels
10800	Toilet Accessories
10916	Shelving Systems

DIVISION 11 - EQUIPMENT

11452	Appliances
-------	------------

DIVISION 14 - CONVEYING SYSTEMS

14____	ADA Lift
--------	----------

DIVISION 15 - MECHANICAL

15010	Supplementary Mechanical Provisions
15100	Basic Materials and Methods
15180	Insulation
15200	Domestic Water
15300	Sanitary Waste
15400	Plumbing

15500	Fire Protection
15650	Refrigeration
15700	Fan Coil Units
15800	Air Distribution
15850	System Test and Balancing
15900	Temperature Controls

DIVISION 16 - ELECTRICAL

16010	Supplementary Electrical Provisions
16110	Raceways and Fittings
16111	Conduits
16112	Surface Raceways
16120	Wire and Cable
16121	Wire Connections and Devices
16131	Junction and Pull Boxes
16133	Cabinets
16134	Outlet Boxes
16140	Wiring Devices
16150	Motors and Electric Powered Equipment
16160	Panelboards
16170	Motors and Circuit Disconnects
16181	Fuses
16190	Supporting Devices
16195	Electrical Identification
16450	Grounding
16491	Disconnect Switches
16500	Lighting
16550	Lighting Control Equipment
16721	Fire Alarm and Detection System
16740	Telephone and Communication/TV Cable
16900	Controls and Instrumentation

END OF TABLE OF CONTENTS

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NOTICE TO BIDDERS / CONTRACTORS:

All submittals and items furnished must be in accordance with all drawings and specifications. The Contractor and all subcontractors are instructed to carefully review all drawings and specifications for all work which may pertain to any installation or specific discipline and coordinate their bids and work accordingly.

In the event of a conflict in the construction documents (drawings and specifications), bidding contractors must identify the conflict through an RFI for resolution prior to bidding. In the event of a conflict identified following award of contract, an RFI shall be submitted for resolution before the item or material is ordered or installed. UNLV will retain the sole right to resolve any such conflicts at no charge or cost from the Contractor or delay in the project.

No substitutions or alternates will be accepted or approved without a written Request for Substitution, detailing the reason for the proposed substitution or alternate and the savings to UNLV in cost and schedule that will result from the proposed substitution. The Request for Substitution must be approved by the UNLV Manager of Construction, the UNLV Director of Construction and the Facilities Management or UNLV Director of Design, in addition to the Professional of Record. In no case shall the time required for consideration of a Request for Substitution be used as a justification for a delay in schedule or additional cost from the Contractor.

No substitutions or alternates may be ordered or installed if this process has not been followed. Any ordered or installed substitutions or alternates noticed at any time during the project that have not been previously approved through the above described process shall be returned or uninstalled without any reimbursement to the Contractor or delay in the project.

Shop Drawing submissions shall not be used to propose substitutions or alternates. The approval of any shop drawing will not constitute the approval of any substitution contained therein, and will not relieve the Contractor of his obligation to replace the item with that specified at no additional cost or delay in schedule.

NOTE:

These Documents and Specifications for this project are part of a “Closed Bid” process meaning there is a select list of Bidders who have already been pre-qualified to submit a Bid for this project.

If you are a General Contractor and are not on the Approved General Contractors List please do not contact any of the Consultants or anyone from UNLV regarding this project. If you would like to be on a future Approved General Contractors List for other projects you must submit your company’s information to UNLV. Please see website for further instructions.

If you are an approved General Contractor UNLV wholeheartedly suggests that our documents and specifications are not posted or published to public websites where anyone has availability to them. If you do post these it would be wise that you put a big note somehow that no phone calls should be directed to UNLV or any of its Consultants but communication should be directed to you.

If you are a Subcontractor and you are seeing these documents under no circumstances should any of your questions be directed to UNLV or to any of the Consultants listed within these documents. All questions need to go to the General Contractors. If you wish to obtain a list of the Approved General Contractors for this project then you may send an email to Benjamin Girardin at bgirardin@10nine.com.

As an approved and bidding General Contractor, provide and price all products as indicated on the Drawings and in the Specifications. Equivalent Manufacturer Products may be submitted. As Owner we reserve the right to reject any submitted equivalent Manufacturer Products at the time of submitting for any cause, in which case the original products as indicated on the Drawings and in the Specifications shall be supplied at no additional cost or change order to the Owner.

END OF NOTICE

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INSTRUCTIONS TO BIDDERS

- 1) The appropriate contract documents have been sent to the qualified list of bidders on this date. This package contains:
 - a) Instructions to Bidders (this document)
 - b) A link to a complete set of plans
 - c) A link to complete set of specifications
- 2) In a separate email you will either receive the items listed below from UNLV or directions to get this information from a website:
 - a) Invitation To Bid
 - b) A line item bid form, showing the required elements is provided. This form has been given to the bidder in hard copy and to follow will be an electronic version of the bid form via email. The contractor is required to submit his final bid in this format. No other format will be accepted.
 - i) This bid form, known as "Schedule A" the Schedule of Values (SOV) is the basis for bid comparison, so the contractor must submit the file on a disk with the hard bid or if this is an "online" Bid the contractor has the option to submit this form "online". The contractor is advised that all applicable line items are to be used. Failure to complete the Bid Form with the proper breakdowns could result in their bid being disqualified.
 - ii) This bid form shall contain the elements of the "Suggested Vendor Program" in the appropriate spaces, with those cells locked and protected.
 - iii) The "Schedule A" (SOV) form shall include a separate line item for Payment and Performance Bond.
 - c) Copy of "Exhibit A" Instructions for "Schedule A"
 - d) A copy of Exhibit B which will become attached to and made a part of the Contract. This Exhibit contains information regarding:
 - i) Change Orders submission information
 - ii) Application and Certificate for Payment submission information
 - iii) Project Communication information
 - iv) Contract and Close Out information
 - e) Exhibit E - Insurance Requirements
 - f) A Letter of Confirmation, to be signed by the bidder, that he has visited the site and is familiar with all conditions and that he agrees that the bid is all inclusive and meets all local codes and conditions. This Letter of Confirmation does not relieve the Contractor of the requirements outlined in Paragraphs 3.1 and 3.2 of AIA DOCUMENT A205 - ELECTRONIC FORMAT GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION OF A SMALL PROJECT - 1993 SMALL PROJECTS EDITION.

- 3) During the bid process, there will be several instances requiring communication with the bidders.
 - a) As noted in the INVITATION TO BID, there will be a Pre-Bid Conference.
 - i) The Pre-Bid Conference shall be held at the location specified in the Invitation to Bid and will be attended by:
 - (1) UNLV Project Manager
 - (2) UNLV Director of Construction
 - (3) UNLV Director of Design
 - (4) Architect
 - (5) All Bidders
 - ii) This conference shall address all of the questions and concerns regarding the contract documents.
 - b) The bidders are encouraged to submit their questions directly to the UNLV Project Manager or the website for clarification using the standard RFI form. When answered, every bidder will receive a copy of the question and answer.
 - c) A Bid Addendum shall be issued in a timely manner that will address the questions raised in this meeting.
 - d) Bidders shall include in their Proposal a list of qualifications and clarifications as to the understanding of the Contract Documents. This will help the Owner in evaluating and understanding the Proposals among the bidders.

END OF SECTION

**SECTION 01016
CONTRACTOR USE OF PREMISES**

PART 1 – GENERAL

1.01 REQUIREMENT

- A. Contractor will be instructed by the Owners Project Manager on the following items:
1. Storage of materials and equipment
 2. Staging
 3. Employee parking
 4. Refuse containers
 5. Other required uses

END OF SECTION

**SECTION 01020
ALLOWANCES**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cash allowances.
- B. Include in Contract Sum cash allowances designated in Owner/Contractor Agreement.
- C. Designate in Progress Schedule delivery dates for products under each allowance.
- D. Designate in Schedule of Values quantities of materials specified under unit cost allowances.

1.02 CASH ALLOWANCES

- A. General:
 - 1. Purchase products under each allowance as directed by UNLV.
 - 2. Allow sums for various products as described in individual specification sections.
 - 3. Amount of allowance includes:
 - a. Net cost of product, less any applicable trade discounts.
 - b. Delivery to site.
 - c. Applicable taxes.
 - d. Labor required under allowance, only when labor is specified to be included in allowance.
 - 4. In addition to amounts of allowances, include in Contract Sum, Contractor's costs for:
 - a. Handling at site, including unloading, uncrating, and storing.
 - b. Protection from elements and from damage.
 - c. Labor for installation and finishing, except where labor is specified to be part of allowance.
 - d. Other expenses required to complete installation.
- B. Selection of Products:
 - 1. Owner's Duties:
 - a. Consult with Contractor in consideration of products and suppliers.
 - b. Make selection; designate products to be used.
 - c. Prepare Change Orders.
 - 2. Contractor's Duties:
 - a. Assist Owner in determining:
 - i. Supplier or installer, as applicable.
 - ii. Cost, delivered and unloaded at site.
 - iii. Cost of installation.
 - b. Obtain proposals from suppliers when requested by Architect.

- c. Notify Owner of any effect anticipated by selection of product or supplier under consideration on construction schedule or contract sum. On notification of selection, enter into purchase agreement with designated supplier.
- C. Delivery:
 - 1. Contractor's Duties:
 - a. Arrange for delivery and unloading.
 - b. Promptly inspect products for damage or defects.
 - c. Submit any claims for transportation damage.
- D. Installation: Comply with requirements of referenced specification section.
- E. Adjustment of Costs:
 - 1. Should actual purchase cost be more or less than specified amount of allowance, Contract Sum will be adjusted by Change Order equal to amount of difference.
 - 2. Amount of Change Order will recognize any changes in handling costs at site, labor, installation costs, overhead, profit, and other expenses caused by selection under allowance.
 - 3. For products specified under unit cost allowance, unit cost shall apply to quantity listed in Schedule of Values.
- F. Submit invoices or other data to substantiate quantity actually used.
- G. Submit any claims for additional costs at site or other expenses caused by selection under allowances, prior to execution of work. Failure to do so will constitute waiver of claims for additional costs.

END OF SECTION

**SECTION 01041
PROJECT COORDINATION**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Project coordination.
 - 2. Project control.

1.02 PROJECT COORDINATION

- A. The General Contractor shall maintain a Daily Job Log that remains open and accessible to the Owner and contains daily weather conditions, work descriptions and a labor breakdown by trade, or any information the Owner deems necessary. All of the information is to enable the Owner to review potential and previously authorized Change Orders and provide satisfactory backup thereof.
- B. The General Contractor shall provide a schedule to the Owner every two weeks which indicates an anticipated completion date. A remarks column must be shown, indicating a narrative on the work that is presently being done and a percent complete for each project. General Contractor shall conduct bi-weekly Subcontract Project Review Meetings. Minutes of meetings and attendees are to be forwarded to UNLV's Field Project Manager
- C. Coordinate scheduling, submittals, and work of various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
- D. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- E. Coordinate space requirements and installation of mechanical and electrical items that are indicated diagrammatically on Drawings. Follow routing shown as closely as practical; place runs parallel with building lines. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Contractor is required to submit a critical path schedule for Owner's review.
- H. Contractor will submit prior to first application for payment a list of all Subcontractors including phone and fax numbers.
- I. The General Contractor shall promptly supply Show Drawings and Submittals requested by Owner.

1.03 PROJECT CONTROL

- A. Once the Contractor has performed final finishes of any type, the project must be maintained in a secure condition where workmen are not present. This requires that all doors and windows must be properly secured and locked. All locks used on the doors must be keyed alike, with the only key remaining in possession of the Contractor. Only the Owner's Representative will be allowed in these finished areas prior to acceptance. Any interim inspections by the Owner's Representative require the presence of the Contractor.

1.04 SCOPE OF WORK

- A. Owner to provide completed grey shell building.

1.05 EXAMINATION OF SITE

- A. General Contractors are required to contact UNLV Project Manager, Scottt McClure, at (702.895-1474) if there any conflicts in the locations of existing utilities different than what is shown on the contract documents for coordination.

1.06 EXAMINATION OF CONTRACT DOCUMENTS

- A. Before submitting Bids, Bidders shall carefully examine the complete Contract Documents, including the drawings and project manual, visit the existing shell building, and shall bring any discrepancies to the attention of the Owner.

1.07 LAWS AND REGULATIONS

- A. General Contractor's attention is invited to the fact that all applicable Federal and State statutes, Municipal Ordinances and the rules and regulations of all Authorities having jurisdiction in the place of construction shall apply to the Contract throughout.

1.08 INTERPRETATION OF DOCUMENTS

- A. Additional information or an interpretation of the Contract Documents and their provision or intent, including drawings and specifications must request such data in writing.

1.09 ADDENDA

- A. General: Answers to all questions, inquiries and requests for clarification or additional information will be issued in the form of ADDENDA to the Drawings and specifications.
- B. Oral Communications: Neither the Architect nor the Owner will be responsible for any explanations or clarifications to the requirements of the Contract Documents, other than through the media of ADDENDA.

- C. Acknowledgment of Receipt: Receipt of each ADDENDUM shall be acknowledged in the Proposal Form, and each such ADDENDUM shall then be considered to be a part of the contract documents.

END OF SECTION

Project Coordination

01041 - 4

01/26/2018

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**SECTION 01090
REFERENCE STANDARDS**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Quality assurance.

1.02 QUALITY ASSURANCE

- A. For products or workmanship specified by reference to association, trade, or industry standards-comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Should specified reference standards conflict with Contract Documents request clarification from Director of Construction before proceeding.
- C. Conform to edition of reference standard in effect as of date of Project Manual.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

END OF SECTION

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**SECTION 01300
SUBMITTALS**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Shop Drawings.
 - 3. Product Data.
 - 4. Samples.
 - 5. Quality control submittals.
- B. Related Sections:
 - 1. Section 01400 - Quality Control.

1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal along with form approved by Owner. Electronic submission preferred.
- B. Number each submittal with Project Manual Specification section number and a sequential number within each section as applicable.
- C. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail numbers as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that:
 - 1. Submittal was reviewed.
 - 2. Products, field dimensions, and adjacent construction have been verified.
 - 3. Information has been coordinated with requirements of Work and Contract Documents.
- E. Schedule submittals to expedite the Project, and deliver to Owner. Coordinate submittal of related items.
- F. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of completed Work.
- G. Each Reviewing person to stamp and list comments on a sheet that is attached to the Transmittal Form.
- H. Revise and resubmit submittals when required; identify all changes made since previous submittal.
- I. Distribute copies of reviewed submittals to concerned parties and to Project Record Documents file. Instruct parties to promptly report any inability to comply with provisions.
- J. Critical Path submittals must be reviewed within 5 working days of when you receive the submittal.
- K. Submittals need to be submitted well in advance to when that item is needed in order to allow for proper review time failure to get these turned in with the appropriate amount of time needed does not constitute the Contractor to be able to submit for delay days.

- L. Submittals are only allowed for two reviews so if any subsequent review is required after the first two then GC will receive a charge from UNLV in the amount of \$150/hour to complete each and every additional review by our consultants.
- M. GC is required to make sure each and every submittal is accurate before submitting.
- N. GC is required to submit clearly in a separate request any items that are being submitted as an alternate.
- O. Review of the submittals by the Architecture and Engineering Consultants is done as a service to GC for Drawing and Product review. The shop drawings shall follow all specifications and drawings. Changes to adherence for Drawings and Specifications shall be submitted by RFI and an approved RFI shall be included with the appropriate shop drawing submittal. All Drawings and Specifications shall be as issued and detailed in AIA Contract between Owner and GC.

1.03 SHOP DRAWINGS

- A. Present in clear and thorough manner.
- B. Identify details by reference to sheet and detail numbers or room number shown on Drawings.
- C. Maximum Sheet Size: 24 x 36 inches.
- D. Submit electronically and follow with one opaque print of each sheet.

1.04 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- B. Submit the number of copies that the Contractor requires, plus two copies that will be retained by the Architect/SRI. If Electronic version is submitted only one copy is required.

1.05 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work. **Items needing samples for submittal are listed on the submittal log.**
- B. Include identification on each sample, with full Project information.
- C. Unless otherwise specified in individual specifications, submit two (2) of each sample.

1.06 QUALITY CONTROL SUBMITTALS

- A. Quality control submittals specified in Section 01400 are for information and do not require Owners responsive action except to require resubmission of incomplete or incorrect information.

END OF SECTION

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**SECTION 01400
QUALITY CONTROL**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Quality assurance and control of installation.
 2. Mockups.
 3. Manufacturer's field services and reports.
 4. Design data and calculations.
 5. Test reports and certifications.
 6. Manufacturer's installation instructions.

1.02 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should the manufacturers' instructions conflict with Contract Documents request clarification from Owner before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 MOCKUPS (Mockups are only required when specifically called out on the Contract Drawings.)

- A. Definition:
1. Mockups are field samples constructed, applied, or assembled at the project site for review by the Owner that illustrate materials, equipment, or workmanship.
 2. Approved mockups establish the standard of quality by which the Work will be judged.
- B. Construct, apply, or assemble specified items, with related attachment and anchorage devices, flashings, seals, and finishes.
- C. Construct, apply, or assemble specified items, with related attachment and anchorage devices, flashings, seals, and finishes.
- D. Erect at project site at location acceptable to Owner. Protect from damage.
- E. Removal:
1. Mockups may remain as part of the Work only when so designated in individual specification sections.
 2. Do not remove mockups until removal is approved by Owner or upon

Final Completion.

3. Where mockup is not permitted to remain as part of the Work, clear area after removal of mockup has been approved by Owner.

1.04 MANUFACTURERS' FIELD SERVICES AND REPORTS

- 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, or startup of equipment, as applicable, and to initiate instructions when necessary.
- B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.05 DESIGN DATA AND CALCULATIONS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide design data and calculations.
- B. Accuracy of design data and calculations is the responsibility of the Contractor.
- C. When so specified, prepare design data and calculations under the direction of a professional engineer licensed in the state in which the Project is located. Affix engineer's seal to submittals.

1.06 TEST REPORTS AND CERTIFICATIONS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide test reports and manufacturers' certifications.
- B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Submittals may be recent or previous test results on material or Product, but must be acceptable to Architect.
- D. Submit two copies of each report.

1.07 MANUFACTURER'S INSTALLATION INSTRUCTIONS

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

Quality Control
01400 - 3
01/26/2018

END OF SECTION

Quality Control
01400 - 4
01/26/2018

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**SECTION 01410
TESTING LABORATORY SERVICES**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Selection and payment.
 - 2. Laboratory duties.
 - 3. Contractor's responsibilities.
- B. Related Sections: Individual specifications sections contain specific tests and inspections to be performed.

1.02 REFERENCES

- A. American Council of Independent Laboratories (ACIL) - Recommended Requirements for Independent Laboratory Qualification.
- B. American Society for Testing and Materials (ASTM) E 329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.03 QUALITY ASSURANCE

- A. Contractor will coordinate the services of an Owner designated independent testing laboratory to perform specified testing and inspection the Owner will pay for the testing.
- B. Contractor shall cooperate with the Testing Laboratory to facilitate performance of its work.
- C. Refer to the Conditions of the Contract for provisions related to special inspections and testing.
- D. Qualifications of Laboratory:
 - 1. Meet ACIL requirements referenced.
 - 2. Meet basic requirements of ASTM E 329.
 - 3. Authorized to operate in State in which project is located.

1.04 LABORATORY DUTIES

- A. Cooperate with Owner and Contractor; provide qualified personnel after due notice.
- B. Perform specified inspections, sampling, and testing of materials and methods of construction:
 - 1. Comply with specified standards.
 - 2. Ascertain compliance or noncompliance of materials with requirements of Contract Documents.
- C. Promptly notify Owner and Contractor of observed irregularities or deficiencies of Work or products.

- D. Promptly submit written report of each test and inspection; one copy to Owner, one copy to the Engineer of Record and two copies to Contractor. Each report shall include:
1. Date issued.
 2. Project title and number.
 3. Testing Laboratory name, address, and telephone number.
 4. Name of Inspector and signature of individual in charge.
 5. Date and time of sampling or inspection.
 6. Record of temperature and weather conditions.
 7. Date of test.
 8. Identification of product and specification section.
 9. Location of sample or test in project.
 10. Type of inspection or test.
 11. Results of tests and compliance or noncompliance with Contract Documents.
 12. Interpretation of test results when requested by Owner.
- E. Perform additional tests when required by Owner.
- F. Laboratory is not authorized to:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Approve or accept any portion of work.
 3. Perform any duties of Contractor.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Laboratory personnel; provide access to Work, and to manufacturer's operations.
- B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.
- C. Furnish copies of product test reports as required.
- D. Furnish incidental labor and facilities:
1. To provide access to work to be tested.
 2. To obtain and handle samples at site or at source of product to be tested.
 3. To facilitate inspections and tests.
 4. For safe storage and curing of test samples.
- E. Notify Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.
- F. When tests or inspections cannot be performed after such notice, reimburse Owner for Laboratory personnel and travel expenses incurred due to Contractor's negligence.
- G. Make arrangements with Laboratory and pay for additional samples and tests required for Contractor's convenience.

END OF SECTION

Testing Laboratory Services

01410 - 3

01/26/2018

Testing Laboratory Services

01410 - 4

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**SECTION 01600
MATERIAL & EQUIPMENT**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Products
 - 2. Transportation and handling.
 - 3. Storage and protection.
 - 4. Product options.
 - 5. Substitutions.

1.02 PRODUCTS

- A. Provide interchangeable components by the same manufacturer for identical items.

1.03 TRANSPORTATION AND HANDLING

- A. Coordinate delivery of Products to prevent conflict with Work and adverse conditions at site.
- B. Transport and handle Products in accordance with manufacturer's instructions.
- C. Promptly inspect shipments to ensure that Products comply with requirements of Contract Documents, are undamaged, and quantities are correct.
- D. Provide equipment and personnel to handle products by methods to prevent damage.

1.04 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions with manufacturer's seals and labels intact and legible.
- B. Store Products on site unless prior written approval to store off site has been obtained from Owner.
- C. Store Products subject to damage by elements in weather tight enclosures. Maintain temperature and humidity within ranges required by manufacturer's instructions.
- D. Exterior Storage:
 - 1. Store fabricated Products above ground; prevent soiling and staining.
 - 2. Cover products subject to deterioration with impervious sheet coverings; provide ventilation to prevent condensation.
 - 3. Store loose granular materials in well drained area on solid surfaces; prevent mixing with foreign matter.
- E. Arrange storage areas to permit access for inspection. Periodically inspect Stored products to verify that products are undamaged and in acceptable condition.

1.05 PRODUCT OPTIONS

- A. Products specified by reference standard only:
 - 1. Select any Product meeting the specified standard.
 - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.
- B. Products specified by naming two or more acceptable Products: Select any named Product.
- C. Products specified by stating that the Contract Documents are based on a Product by a single manufacturer followed by the statement "Equivalent products by the following manufacturers are acceptable":
 - 1. Select the specified Product or a Product by a named manufacturer having equivalent or superior characteristics to the specified Product and meeting all requirements of the Contract Documents.
 - 2. If the specified Product is not selected, submit Product Data to substantiate compliance of proposed Product with specified requirements.
 - 3. The specified Product establishes the required standard of quality.
- D. Products specified by naming a single Product followed by "or approved substitute" or similar statement:
 - 1. Submit a Substitution Request Form for Products not listed.
 - 2. The specified Product establishes the required standard of quality.
- E. Products specified by naming one or more Products or manufacturers followed by the statement "Equivalent products by the following manufacturers are acceptable": Submit a Substitution Request Form for Products not listed.
 - 1. The specified Product establishes the required standard of quality.
- F. Products specified by naming one Product followed by the statement No Substitutions or named within the National Buying Program. Substitutions will not be allowed unless approved by Owner.
- G. Products specified by required performance or attributes, without naming a manufacturer or Product:
 - 1. Select any Product meeting specified requirements.
 - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

1.06 SUBSTITUTIONS

- A. Do not substitute Products unless a Substitution Request Form has been approved by Owner.
- B. In case of non-availability of a specified Product notify Owner in writing as soon as non-availability becomes apparent.
- C. Submit Substitution Requests using Substitution Request Form provided. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents, including:
 - 1. Product identification, including name and address of manufacturer.
 - 2. Product description, performance and test data, and reference standards.

3. Sample, if requested.
 4. Description of any anticipated effect that acceptance of proposed Substitution will have on Progress Schedule, construction methods, or other items of Work.
 5. Description of any differences between specified product and proposed Substitution.
- D. Submit the number of copies required by the Contractor, plus two copies that will be retained by the Owner.
- E. A request constitutes a representation that the Contractor:
1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 2. Will provide the same warranty for the Substitution as for the specified Product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- F. Will reimburse Owner for design services associated with re-approval by authorities or revisions to Contract Documents to accommodate the Substitution.
- G. Substitutions will not be considered if:
1. They are indicated or implied on Shop Drawings or other submittals without submittal of a Substitution Request Form.
 2. Acceptance will require substantial revision of Contract Documents.
- H. Owner will notify Contractor in writing of acceptance or rejection of Substitution Request.

END OF SECTION

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SECTION 01700
CLEANING, ADJUSTMENTS & SYSTEMS DEMONSTRATIONS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cleaning.
 - 2. Adjusting.
 - 3. Systems Demonstrations.

1.02 FINAL CLEANING

- A. Contractor or Subcontractor shall remove and dispose of all tools, equipment, surplus material and rubbish pertaining to his work, cooperation in final cleaning by General Contractor.
- B. Execute final cleaning prior to final inspection.
- C. Clean surfaces exposed to view:
 - 1. Clean windows and doors.
 - 2. Remove temporary labels, stains and foreign substances.
 - 3. Polish transparent and glossy surfaces.
 - 4. Vacuum carpeted surfaces; damp mop hard surface flooring.
- D. Clean equipment and fixtures to a sanitary condition.
- E. Clean or replace filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.03 ADJUSTING

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

1.04 SYSTEMS DEMONSTRATIONS

- A. Each separate system with its various components shall be operated by this contractor or his subcontractors for a responsible length of time to demonstrate the performance of all equipment and piping in accordance with the true intent and purpose of the plans and specifications. All necessary adjustments shall be made to the satisfaction of the Owner.

END OF SECTION

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**SECTION 02100
SITE PREPARATION**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Removal of surface debris.
 - 2. Removal of plant life and grass.
 - 3. Grubbing roots.
- B. Related Sections:
 - 1. None

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 SITE CLEARING

- A. Remove vegetation, debris, and obstructions from areas of structures, walks, and paving.
- B. Apply herbicide to remaining stumps and plant life to inhibit growth.
- C. Grub out roots and underground obstructions to minimum depth of 12 inches.
- D. Material Disposal:
 - 1. Remove waste material from site as it accumulates.
 - 2. Comply with applicable codes and ordinances regarding waste transportation and disposal.

3.02 SWPPP

- A. It is the general contractor's responsibility to maintain the SWPPP reporting and maintenance once the site contractor has left the site.

END OF SECTION

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**SECTION 02200
EXCAVATION, BACKFILLING & COMPACTION**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Trenching for utilities.
 - 2. Backfilling and compacting.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D 4318-05 – Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - 2. D 4318-05 – Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.03 SYSTEM DESCRIPTION

- A. Limits of Work: Do not extend earthwork beyond areas of excavation or construction shown on Drawings or reasonably necessary for performance of Work.
- B. Contractor is responsible for design of temporary earth retention systems.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Select Fill:
 - 1. Reused site or imported soils with a liquid limit less than 30 and a plasticity index between 4 and 15 when tested in accordance with ASTM D 424.
 - 2. Free from trash, debris, vegetation, roots over 1 inch in diameter, matted roots, rocks over 3 inches in diameter, topsoil, and other deleterious matter.
- B. Common Fill: Reused site soils or imported soils free from trash, debris, roots over 1 inch in diameter, matted roots, rocks over 3 inches in diameter, topsoil, soils, and other deleterious matter.
- C. Source Quality Control:
 - 1. Testing Laboratory Services: Test proposed fill prior to use to determine compliance with specified requirements.

PART 3 – EXECUTION

3.01 EXCAVATING

- A. Excavate to grades and sub-grades indicated. Make excavations large enough to permit placing and inspection of work.
- B. Stockpile excavated materials that are suitable for reuse separately from sub-grade material.
- C. Remove and dispose of excavated material that is unsuitable or not required for backfilling. Remove underground obstructions.
- D. Brace sides of excavations where necessary; maintain until permanent construction is in place. Remove temporary shoring and bracing as backfill is placed.
- E. Excavation for Structures:
 - 1. Form bottoms of excavations reasonably level.
 - 2. Maintain moisture level in excavations as near their natural level as possible.
- F. Keep excavations free of water.

3.02 TRENCHING

- A. Cut trenches sufficiently wide to allow for installation of utilities and for inspection of work.
- B. Hand-trim excavations; remove loose matter.
- C. Remove rocks and obstructions.
- D. Correct over-excavation by use of lean concrete or pipe bedding material.
- E. Keep trenches free of water.

3.03 BACKFILLING

- A. Backfill under structures with Select Fill.
- B. Backfill outside of structures and under paving with Common Fill.
- C. Place backfill in loose, even, horizontal lifts maximum 6 inches deep.
- D. Compact each lift to following minimum 95 percent (+/-2 percent) of ASTM D 698 standard Proctor maximum dry density at a moisture content from optimum to 3 percent above optimum.
- E. When moisture must be added to aid in compaction, uniformly apply water to surface, but do not flood. Free water shall not appear on surface during or after compaction operations.
- F. Scarify soil too wet for proper compaction and allow to dry. Replace and re-compact.
- G. Uniformly grade areas to smooth surface at required grades and elevations. Adjust contours to eliminate water ponding and provide positive drainage. Make grade changes gradually. Blend slopes into level grades.
- H. Tolerances: Within plus or minus 1 inch of required sub-grade elevation.

3.04 FIELD QUALITY CONTROL

- A. Testing Laboratory Services: Perform field in place density tests, ASTM D 2922, as follows; minimum of three tests for each lift or area:
 - 1. Trenches: One test for each 300 linear feet, per lift.

3.05 CLEANING

- A. Remove surplus materials and those not suitable for reuse from site.

3.06 PROTECTION

- A. Protect graded areas from traffic and erosion; keep free of trash and debris.

END OF SECTION

Excavation, Backfilling & Compaction

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SECTION 02900
LANDSCAPING & SPRINKLER IRRIGATION SYSTEMS REPAIR

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Repair all landscaping as shown on drawings. Repair irrigation system as necessary. Trenching and backfill. Furnish Record Drawings.

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing and installing materials.
 2. All work and materials shall be in full accordance with latest rules and regulations of safety orders of Division of Industrial Safety; the Uniform Plumbing Code and other applicable laws or regulations, including the local city Plumbing Code.
 3. Exact locations of all sprinkler heads, valves, piping, wiring, etc., shall be established by the Contractor at the time of construction.
 4. Nothing in these Specifications is to be construed to permit work not conforming to these codes. Should the Contract Documents be at variance with the aforementioned rules and regulations, notify Owner and get his instructions before proceeding with the work affected.
- B. Workmanship: All work shall be performed by people proficient and experienced in the trades required in a neat and orderly manner.
- C. Reference Standards: Current published standards, specifications, tests or recommended methods of trade, industry or governmental organizations apply to work of this Section where cited by abbreviations noted below.
1. American Society of Testing and Materials (ASTM)
- D. Testing:
1. Preliminary review of completed installation will be made by Architect prior to backfilling of trenches and during hydrostatic testing.
 2. Final review shall be made in conjunction with the final review of lawn, shrub and tree planting.
- E. Permits and Fees:
1. Obtain all permits and pay required fees to any agency having jurisdiction over the work.
 2. Arrange inspections required by local agencies and ordinances during the course of construction, as required.

1.03 SUBMITTALS

- A. Materials List:

1. All submittal data shall be forwarded in a single package to Architect within seven (7) days of award of the Contract.
 2. Equipment or materials installed or furnished without prior approval of the Architect may be rejected if the materials are not in compliance with the Contract Documents and the Contractor will be required to remove such materials from the site at his own expense.
 3. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- B. Samples: The Architect reserves the right to request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of replacement of materials not meeting specifications shall be paid by Contractor.
- C. Substitutions:
1. Specific reference to manufacturer's names and products specified in this Section are used as standards, but this implies no right to substitute other material or methods without written approval of the Owner/Architect.
 2. Installation of any approved substitution is Contractor's responsibility. Any changes required for installation of any approved substitution must be made to the satisfaction of Architect and without additional cost to Owner.
 3. Approval by Architect of substituted equipment and/or dimensional drawings does not waive these requirements.
- D. Record Irrigation Drawings: Contractor shall furnish Record Drawings of the complete irrigation system in accordance with the General and Special Conditions. Construction drawings shall be on the construction site at all times while the irrigation system is being installed. Actual location of valves and quick identified permanent features, such as buildings, curbs, fences, walks or property lines. The record drawings shall be turned over as required by the Contract Documents.
1. In addition to the above mentioned maintenance manual, provide the Owner's maintenance personnel with instructions for complete operation of irrigation system, including start-up and shut-down procedures.
- E. "Attic" Equipment: Equipment to be furnished:
1. Supply as a part of this contract two (2) each of the following tools:
 - i. Special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.
 - ii. Six (6) foot valve keys for operation of gate valves or stop and waste valves (if applicable).
 - iii. Keys for each automatic controller.
 - iv. Quick coupler keys and matching hose swivels for each type of quick coupling valve installed.
 2. The above-mentioned equipment shall be turned over to the Owner at the conclusion of the project.

1.04 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.
- B. Store products with protection from weather or other conditions, which would damage or impair the effectiveness of the product.

1.05 JOB CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. Should utilities or other work not shown on the drawings be found during excavations, Contractor shall promptly notify Landscape Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on drawings.
- B. Contractor shall take necessary precautions to protect site conditions and plants to remain. Should damage be incurred, this Contractor shall repair damage to its original condition or furnish and install equal replacement at his expense.

1.06 INSPECTIONS

- A. Submit written requests for inspections to the Architect at least forty-eight (48) hours prior to anticipated inspection date. Work is not to be delayed waiting for inspections.
- B. Inspection of completed installation will be made by Architect prior to backfilling of trenches and will be made during hydrostatic testing.
- C. Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, etc., during Guarantee Period. Report such conditions to Owner in writing.

1.07 FINAL ACCEPTANCE

- A. Work under this Section will be accepted by Owner upon satisfactory completion of all work. Work will be accepted building by building, not as one complete site installation. Upon Final Acceptance, Owner will assume responsibility for maintenance of the work. Said assumption does not relieve Contractor of obligations under Warranty.

1.08 WARRANTY

- A. In addition to manufacturer's guarantees or warranties, all work shall be warranted for one year from the date of Final Acceptance against defects in material, equipment and workmanship by Contractor. Warranty will be based on single building acceptance schedule.

1.09 CLEAN-UP

- A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Owner.

PART 2 – MATERIALS

2.00 BACKFLOW PREVENTOR

- A. Backflow Prevention Device as approved by the local city code.

2.01 PIPE

- A. Piping on pressure side of irrigation control valves:
 - 1. Two and one-half (2 ½") inch diameter and smaller – Polyvinyl chloride (PVC) 1120-1220, Class 200 and shall conform to ASTM D-2241-73.
- B. Piping on non-pressure side of irrigation control valves:
 - 1. Polyvinyl chloride (PVC) 1120-1220, SDR 21.0, Class 200, and shall conform to ASTM D 2241-73, except one-half (1/2") inch diameter shall be Class 315.
- C. Identification: All piping shall be continuously and permanently marked with the following:
 - 1. Manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees F, and National Sanitation Foundation (N.S.F.) approval.

2.02 FITTINGS

- A. Fittings for Solvent-Welded Pipe:
 - 1. Schedule 40, polyvinyl chloride, standard weight, as manufactured by "Sloane", "Lasco", or approved equal, to meet ASTM D-2466-73 and 2467-73.
 - 2. Threaded PVC Nipples – Schedule 80 PVC.
- B. Furnish three valve keys fitted with three-quarter (3/4") inch swivel hose ends.

2.03 SPRINKLER HEADS

- A. Drip Irrigation Heads to match existing

PART 3 - EXECUTION

3.01 LAYOUT

- A. No consideration will be given to any design changes until after the awarding of the contract. Should any changes be deemed necessary after award of contract for proper installation and operation of the system, such changes, except for minor layout adjustments, shall be approved through the change order procedure.
- B. Full and complete irrigation is required. Contractor shall make any necessary adjustments to layout required to achieve full coverage or irrigated areas at no additional cost to Owner.
- C. The Contractor will stake out the location of each run of pipe and all sprinkler heads of sprinkler valve locations prior to trenching.

3.02 EXCAVATING AND TRENCHING

- A. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.
- B. Should utilities not shown on the drawings be found during excavations. Contractor shall promptly notify Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the Record Drawings promptly.
- C. Dig trenches wide enough to allow a minimum of four (4") inches between parallel pipe lines.
 - 1. Over pipe on pressure side of irrigation control valve, control wires and quick coupling valves: 18 inches.
 - 2. Over pipe on non-pressure side of irrigation control valve: 12 inches.
 - 3. All PVC pipe under paving shall be bedded with minimum of four (4") inches of sand backfill on all sides and have twenty-four (24") inch cover. All piping and wiring which is located under paving, walks, or decks of more than six (6') distance shall be placed in schedule 40 PVC sleeving.

3.03 PIPE LINE ASSEMBLY

- A. General
 - 1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
 - 2. Clean all pipes and fittings of dirt, scales and moisture before assembly.
 - 3. All pipe, fittings and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be closed by approved means.
 - 4. All lateral connections to the mainline as well as all other connections shall be made to the side of the mainline pipe. No connections to the top or bottom of the line shall be allowed.

- B. If water jets are used in connection with the driving, the ultimate pile capacity shall be determined from the results of driving after the jets have been withdrawn. Solvent-Welded Joints for PVC Pipes
 - 1. Use solvents and methods by pipe manufacturer.
 - 2. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty-four (24) hours before placing the joint under water pressure.
- C. Threaded Joints for Plastic Pipes
 - 1. Use Teflon tape on the threaded PVC fittings except where Marlex fittings are used.
 - 2. Use strap-type friction wrench only: Do not use metal-jawed wrench.
 - 3. When connection is plastic to metal, male adapters shall be used on the metal pipe. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal upon approval.
- D. Laying of Pipe:
 - 1. Pipes shall be bedded in at least two (2") of finely divided material with no rocks or clods over one (1") inch diameter to provide a uniform bearing.
 - 2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
 - 3. Do not lay PVC pipe when there is water in the trench.
 - 4. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
 - 5. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.
 - 6. All plastic to plastic joints except polyethylene shall be solvent-weld joints or slip seal joints. Only the solvent recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

3.04 SPRINKLER HEADS

- A. Drip Irrigation heads shall be provided and sized properly for each plant.

3.05 TESTING

- A. Make hydrostatic tests when welded PVC joints have cured as per manufacturer's instructions.
- B. Pressurized Mains
 - 1. Completely install water meter, mains, isolation valves and control valves. Do not install laterals.
 - 2. Open all isolation valves.
 - 3. Fill all lines with water.
 - 4. Monitor gauge for pressure loss for four (4) hours.
 - 5. Leave lines and fittings exposed throughout testing period.
 - 6. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
 - 7. Test all isolation valves for leakage.
- C. Non-Pressure Laterals:
 - 1. Test piping after laterals and risers are installed and system is fully operational.
 - 2. Leave trenches open to detect possible leaks.

3.06 BACKFILL AND COMPACTING

- A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.
- B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum ninety-five (95%) percent density under pavements, ninety (90%) percent under planted areas.
- C. Compact trenches in areas to be planted by thoroughly water settling the backfill. Jetting process will be used in those areas.
- D. Dress off all areas to finish grades. Site shall be dressed to a condition equal or better than condition site was received by this Contractor. Contractor will remove all exceed backfill material from the site and dispose of property.

3.07 GUARANTEE

- A. The Contractor shall warrant all materials and workmanship for one (1) year from Final Acceptance. Acceptance will be building by building as the system for each building becomes operational, not as one complete project.
- B. The Contractor shall, at his own expense, make all needed repairs or replacements due to defective workmanship or materials which in the judgment of the Architect shall become necessary during such period. If, within ten (10) days after mailing of a written notice or verified communication by the Owner to the Contractor requesting such repairs or replacement, the Contractor neglects to make or have made those repairs, the Owner may make such repairs at the Contractor's expense. However, in the case of emergency where, in the judgment of the Owner, delay would cause serious loss or damage, repairs or replacement may be made after verbal communication with Contractor followed by notice sent to the Contractor.

- C. Any expense due to vandalism before Final Acceptance shall be borne by the Contractor. Owner shall also be responsible for maintaining turf and planting areas after Final Acceptance and during guarantee period, so as not to hamper proper operation of irrigation system.

3.08 CLEAN-UP

- A. Keep all areas of work clean, neat and orderly at all times. Keep paved areas clean during construction. Clean up and remove all debris from the entire work area prior to Final Acceptance to satisfaction of Owner.

END OF SECTION

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SECTION 03100 CONCRETE FORMWORK

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to concrete formwork as described herein and/or as shown on the drawings.

1.02 RELATED WORK

- A. Section 03300: Cast-In-Place Concrete.

1.03 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 347 and applicable construction safety regulations for place of work.

1.04 REFERENCE STANDARDS

- A. ACI 318-12 - Building Code Requirements for Structural Concrete.
- B. ACI 347 - Recommended Practice for Concrete Formwork.

PART 2 – PRODUCTS

2.01 WOOD FORM MATERIALS

- A. Plywood: Form grade; sound undamaged sheets with clean true edges.
- B. Lumber: Softwood species; with grade stamp clearly visible.
- C. Nails, Spikes, Lag Bolts, Through Bolts, and Anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while placing concrete.

2.02 FORMWORK ACCESSORIES

- A. Form Ties: If required, use snap-off metal type of adjustable length; minimum working strength of 3000 pounds when assembled; free of defects that will leave holes no larger than 1 inch in concrete surface.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete.

PART 3 - EXECUTION

3.01 FORMWORK ERECTION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.
- B. Construct formwork, shoring and bracing to meet design and code requirements, so that resultant finished concrete conforms to required shapes, lines and dimensions.
- C. Arrange and assemble formwork to permit dismantling and stripping, so that concrete is not damaged during its removal.
- D. Align joints and make water tight, to prevent leakage of mortar disfigured appearance of concrete. Keep form joints to minimum.
- E. Obtain Engineer's review before framing openings in structural members, which are not indicated on drawings.
- F. Provide bracing to ensure stability of formwork. Prop or strengthen previously constructed formwork that might be over-stressed by construction loads. Bracing method needs to be approved by Owner and Engineer prior to installation.
- G. Construct formwork to maintain following maximum tolerances:
 - 1. Deviation from horizontal and vertical lines:
 - a. 1/4 inch in 10 feet.
 - b. 3/8 inch in 20 feet.
 - c. 3/4 inch in 40 feet.
 - 2. Deviation of building dimensions indicated on drawings and position of columns, walls and partitions:
 - a. 1/2 inch.
- H. Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel anchoring devices, and embedded items.
- I. Do not apply form release agent where concrete surfaces will receive special finished or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.02 INSERTS, EMBEDDED PARTS AND OPENINGS

- A. Locate and set in place items which will be cast directly into concrete.
- B. Coordinate work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.
- C. Do not perform work unless specifically indicated on drawings or reviewed prior to installation.
- D. Install concrete accessories in accordance with manufacturer's recommendations; straight, level and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

- F. Close temporary ports or openings with tight-fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.
- G. Protect forms from moisture before concrete placing
- H. Protect forms from crushing during concrete placement.

3.03 FIELD QUALITY CONTROL

- A. Inspect and check completed formwork, shoring and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties and parts are secure.
- B. Inform Architect and Engineer when formwork is complete and has been cleaned, to allow for inspection.
- C. Obtain review prior to placing concrete.
- D. Verify strength of concrete by compressive test

3.04 FORM REMOVAL

- A. Do not remove forms, shores and bracing until concrete has gained sufficient strength to carry its own weight, and construction and design load which are liable to be imposed upon it.
- B. Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- C. Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

END OF SECTION

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**SECTION 03210
REINFORCING STEEL**

PART 1 – GENERAL

1.01 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Where a date is given for reference standards, that edition shall be used. Where no date is given for reference standards, the latest edition available on the date of Notice Inviting Bids shall be used.
- B. American Concrete Institute (ACI):
 - 1. ACI 301, Structural Concrete for Buildings.
 - 2. ACI 318, Building Code Requirements for Structural Concrete.
 - 3. ACI SP-66, Detailing Manual, (including ACI 315 and ACI 315R).
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 2. ASTM A479, Standard Specification for Plain or Deformed Woven Wire Mesh.
- D. Concrete Reinforcing Steel Institute (CRSI):
 - 1. MSP-2-01, Manual of Standard Practice for Reinforced Concrete Construction.
 - 2. CRSI 63, Recommended Practice for Placing Reinforcing Bars.
 - 3. CRSI 65, Recommended Practice for placing bar supports, Specifications and Nomenclature.

1.02 SUBMITTALS

- A. Shop drawings shall be prepared in accordance with the requirements of CRSI Manual of Standard Practice (MSP-2-01) and the ACI Detailing Manual SP-66, ACI 315.
- B. Submit shop drawings for approval to Owner and Engineer of Record at least 14 days prior to fabrication.
- C. Prepare placement drawings indicating bar sizes; spacing; locations and quantities of reinforcing steel; bending and cutting schedules; supporting and spacing devices; and lap splice locations.
- D. Submit certified copies of mill test reports of reinforcement material analysis.

PART 2 – PRODUCTS

2.01 DEFORMED REINFORCING BARS

- A. Deformed billet-steel bars shall be in accordance with requirements of ASTM A615, Grade 60, including Supplemental Requirements.
- B. Deformed Welded Wire Mesh shall be in accordance with requirements of ASTM A479.

2.02 ACCESSORIES

- A. Tie wire shall be soft-annealed wire, minimum 16 gauge.
- B. Cement-mortar support cubes shall be of the same strength and density as the concrete in the section being placed.
- C. Rebar Supports shall be plastic or formed dobie blocks. Acceptable products are the Aztec E-Z Chair – PEZ, or the Plain Dobie – CPD supplied by Dayton Superior Concrete Accessories, Inc. or equal. Supports shall conform to CSRI Class 1.
- D.

PART 3 - EXECUTION

3.01 GENERAL

- A. Reinforcement shall be fabricated and placed in accordance with approved shop drawings.
- B. Reinforcement fabrication and erection shall be in accordance with the requirements of these specifications and to those applicable provisions not in conflict with the requirements specified herein of CRSI MSP-2-01 and CRSI 63 and 65.
- C. The Contractor shall notify the Engineer and Local Inspector as required when reinforcing is ready for inspection and allow sufficient time for this inspection prior to placing concrete. Concrete placed without inspection will be subject to rejection and removal at no cost to the Owner.

3.02 FABRICATION

- A. All reinforcement shall be cut and bent in accordance with ACI 315. Bars shall be bent cold and shall be delivered to the job bundled and tagged in a manner that will permit easy identification as to the location in the work.

1.03 PLACING REINFORCING STEEL

- A. General: Reinforcing steel placement shall be in accordance with the requirements of ACI 318 and SP-66.
- B. Cleaning: Reinforcement shall be thoroughly cleaned of all dirt, loose mill scale, rust, and other substances which would impair the bond between steel and concrete. Reinforcing steel shall be protected from frost prior to placement of concrete.

- C. Straightening and Re-bending: Reinforcement shall not be straightened or re-bent.
- D. Spacing and Positioning:
 - 1. Bars shall be placed accurately in the positions and with the spacing shown on the approved shop drawings and shall be securely fastened in position so as to prevent displacement.
 - 2. Reinforcement shall be placed not closer than two inches to formed surfaces of concrete in contact with water, ground, or air, or three inches to the surfaces of concrete placed against the ground, unless otherwise shown on the drawings.
 - 3. Reinforcement shall be placed not closer than three inches to any embedded piping or sleeves passing through walls or slabs, unless otherwise shown on drawings.
- E. Splicing:
 - 1. Bars shall be spliced only at points shown on the approved bending lists and drawings or where approved by the Engineer.
 - 2. Wherever bars are spliced, they shall be lapped to meet the requirements for a Class B tension lapped splice in accordance with ACI 318, unless otherwise shown on the drawings. For bars of different sizes, the lap length shall be that given for the smaller size bar or shall be equal to the required embedment for the larger size bar, whichever is greater. Bars in lapped splices shall be in contact and shall be tied in a manner which maintains bar spacing shown on the drawings.
- F. The Contractor shall place an equivalent area of steel around the pipe or opening and extend on each side sufficiently to develop bond in each bar. Bar extension length on each side of opening shall be as shown on the drawings. Where welded wire fabric is used, extra reinforcement shall be provided using fabric or deformed bars.

END OF SECTION

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**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Section Includes: Submittals Testing, cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
1. A82 Specification for Steel Wire, Plain, for Concrete Reinforcement
 2. A497 Specification for Steel Welded Wire Fabric, Deformed, for Concrete
 3. A615 Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
 4. C33 Specification for Concrete Aggregates
 5. C94 Specification for Ready-Mixed Concrete
 6. C150 Specification for Portland Cement
 7. C260 Specification for Air-Entraining Admixtures for Concrete
 8. C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 9. C494 Specification for Chemical Admixtures for Concrete
 10. C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
 11. C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink)
 12. C1116 Specification for Fiber-Reinforced Concrete and Shotcrete
 13. D994 Specification for Preformed Expansion Joint Filler for Concrete
 14. D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
 15. E1643 Standard Practice for Installation of Water Vapor Retarders
 16. E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.03 SUBMITTALS

- A. General: Submit the following items in accordance with the Conditions of Contract and Division 1, Section "Descriptive Submittals".

- B. Product Data: Submit product data for the following materials and items.
1. Reinforcement
 2. Forming Accessories
 3. Admixtures
 4. Patching Compounds
 5. Hardener
 6. Joint Systems
 7. Curing Compounds
 8. Sealants
- C. Shop Drawings: Submit shop drawings, when indicated, for fabrication, bending and placement of concrete reinforcement. Show bar schedules, stirrup spacing, diagrams of bent bars and arrangement of reinforcement including bar overlap. Include any special reinforcement required for openings through concrete structures.
- D. Laboratory Test Reports: Submit concrete materials test reports and mix design reports certifying that each material or item complies with or exceeds the specified requirements.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the latest edition or revision of the following, except as otherwise indicated:
1. ACI 301 "Specifications for Structural Concrete for Buildings"
 2. ACI 302 "Guide for Concrete Floor and Slab Construction"
 3. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete"
 4. ACI 305 "Hot Weather Concreting"
 5. ACI 306 "Cold Weather Concreting"
 6. ACI 308 "Standard Practice for Curing Concrete"
 7. ACI 309 "Standard Practice for Consolidation of Concrete"
 8. ACI 315 "Details and Detailing of Concrete Reinforcement"
 9. ACI 318 "Building Code Requirements for Structural Concrete"
 10. ACI 347 "Recommended Practice for Concrete Formwork"
 11. CRSI "Manual of Standard Practice"
 12. SP-66 "ACI Detailing Manual"
- B. Materials and installed work may require testing and retesting, as directed by the Owner or Engineer, at any time during progress of work. All testing of materials will be at SRI's expense unless the test fails. Then any additional testing required by the Owner or Engineer will be at the Contractors expense. Each concrete truck will be monitored at the site for concrete temperature, revolution count, and time of mixing. Every truck for each placement will be tested for slump and percentage air. Additional testing may occur at any time during progress of work. Compression test cylinders will be made for each truck that has been accepted for slump and air content.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

- A. Forms shall be of metal, wood or fiberglass with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Forms for exposed surfaces shall be free of holes, splits, surface voids, and other defects which can affect finished concrete surface. Forms for concrete columns shall be manufactured for such applications and not be field built.
- B. Cylindrical Columns and Supports: Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Use factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
 - 1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1/2" (12.7 mm) inside concrete for steel ties and 1/4" (6.35 mm) for wire ties.
 - 2. Unless otherwise shown, provide form ties which will not leave holes larger than 1" (25.4 mm) diameter in concrete surface.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, deformed. (Epoxy coated in accordance with ASTM A934 where indicated on the drawings.)
 - 1. Provide Grade 40 bars No. 3 and 4 for stirrups and ties.
 - 2. Provide Grade 60 bars No. 3 to 18, except as otherwise noted.
- B. Welded steel wire fabric: ASTM A497. Furnish in flat sheets, not rolls, unless rolls are acceptable to the Engineer.
Cold-drawn steel wire: ASTM A82.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150 Types I-II and III unless otherwise specified. All types of Portland Cement for paving and sidewalks shall be "low-alkali cement."
- B. Aggregates: ASTM C33
- C. Water: Potable

- D. Fly Ash: Not permitted.
- E. Admixtures: Admixtures indicated below when used shall be specified in the submitted mix design and approved in writing by the Engineer prior to installation.
 - 1. Air-Entraining Admixture: ASTM C260
 - 2. Water-Reducing Admixture: ASTM C494, Type A and F.
 - 3. High Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G. (Only allowed in formed building columns unless specifically noted otherwise)
 - 4. Water-Reducing, Retarding Admixture: ASTM C494, Type D.
 - 5. Chloride-containing admixtures are not permitted.

2.04 RELATED MATERIALS

- A. Expansion Joint Materials: Premolded strips of a bituminous mastic composition conforming to ASTM D994.
- B. Non-Shrink Grout: ASTM C1107 (formerly referenced as CE CRD C621), factory pre-mixed grout, non-metallic.
- C. Spray-Lock Permanent Concrete Protection: SCP327
- D. Bonding Compound: Polyvinyl acetate, re-wettable type.
- E. Under Slab Vapor Retarder: Vapor retarder shall have the following minimum characteristics.
 - 1. Minimum permeance: 0.1 perms
 - 2. Minimum tensile strength: 30 lbf/in.
 - 3. Minimum puncture resistance: 1700 grams
 - 4. Minimum thickness: 10 mils
 - 5. ASTM E1745-09 Class B
- F. Vapor Retarder Seam Tape: Adhesive or pressure sensitive tape having the same qualities as the retarder material and supplied by the retarder material manufacturer. Minimum width: 4 inches.

2.05 CONCRETE MIX DESIGN

- A. General
 - 1. Unless otherwise specified, the minimum compressive strength of concrete shall be 3000 psi (210.9 kgs-sq cm) at 28 days.
 - 2. Concrete columns shall have a minimum compressive strength of 4,000 psi (281.2 kgs-sq cm) at 28 days. No exceptions.
 - 3. Concrete mixtures shall produce the necessary workability in fresh concrete and the desired strength.
 - 4. Unless otherwise approved or specified, all concrete shall be "Ready-Mixed" in accordance with ASTM C94.
 - 5. The water-cement ratio selected shall be that required to produce a 28-day strength corresponding to an over designed mix which is supported by sufficient experience data to assure that test results will fall within the

limits established in this specification. The minimum cement content shall be 5.0 bags per cubic yard of concrete.

6. Allowable Slump:

Allowable Slump	Min-Max (In.)
Slabs, Beams, Walls and Columns	3-4
Concrete containing water reducing admixture	3-5
Concrete containing super plasticizer	6-8

B. Aggregate: Aggregate Grading shall be as follows for the different strengths of concrete.

1. Coarse Aggregate shall be as per ASTM C33, Table 2, Grading Requirements for Coarse Aggregates. Minimum #57 but no larger than one fifth the narrowest dimension between sides of forms, one third the depth of the slab, three fourths of the minimum spacing between reinforcing bars, and $\frac{3}{4}$ " for interior slabs.
2. Fine Aggregate shall be as per ASTM C33, Sieve Analysis, Fine Aggregate.

C. Admixtures

1. Use air-entraining admixture in exterior exposed concrete only when specifically indicated on the drawings.

PART 3 - EXECUTION

3.01 FORMS

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Provide for openings, keyways, chamfers, inserts and other features required in work. Maintain formwork construction tolerances, unless otherwise indicated:

1. Variation from Plumb:

- a. In the lines and surfaces of columns, piers, walls, and in arises:

In any 10 ft. (3.05 m) of length	1/4 in. (6.4 mm)
Maximum for the entire length	1 in. (25.4 mm)

- b. For exposed corner columns, control-joint grooves, and other conspicuous lines:

In any 20 ft. (6.10 m) of length	1/4 in. (6.4 mm)
Maximum for the entire length	1/2 in. (12.7 mm)

2. Variation from the level or from the grades specified in the contract drawings:

- a. In slab, ceilings, beams, measured before removal of supporting shores:

In any 10 ft. (3.05 m) of length	1/4 in. (6.4 mm)
In any bay or in any 20 ft. (6.10 m) length	3/8 in. (9.7 mm)
Maximum for the entire length	3/4 in. (19 mm)

- b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

In any bay or in any 20 ft. (6.10 m) length	1/4 in. (6.4 mm)
Maximum for the entire length	1/2 in. (12.7 mm)

3. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:

- a. Cast in Place Concrete

In any bay	1/2 in. (12.7 mm)
In any 20 ft. (6.10 m) of length	1/2 in. (12.7 mm)
Maximum for the entire length	1 in. (25.4 mm)

4. Variation in the sizes and location of sleeves, floor openings, and wall openings

	1/4 in. (6.4 mm)
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5. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:

Minus	1/4 in. (6.4 mm)
Plus	1/2 in. (12.7 mm)

6. Footings:

- a. Variations in cross sectional width:

Minus	1/2 in. (12.7 mm)
Plus	2 in. (50.8)

- b. Misplacement or eccentricity:

2 percent of the footing width in the direction of misplacement but not more than	2 in. (50.8)
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- c. Thickness

Decrease in specified thickness	5%
Increase in specified thickness	No Limit

7. Variation in Steps*:

- a. In a flight of stairs:

Rise	+1/8 in. (+3.2 mm)
Tread	+1/4 in. (+6.4 mm)

- b. In consecutive steps:

Rise	+1/16 in. (+1.5 mm)
Tread	+1/8 in. (+3.2 mm)

*Tolerances apply to concrete dimensions only.

- B. Design and fabricate formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Chamfer exposed corners and edges as indicated in the drawings to produce uniform smooth lines and tight edge joints.
- D. All curb and combined curb and gutter shall be divided into blocks or stones in lengths not to exceed 6 feet (1.83 m) long using metal templates not less than 1/16 inch (1.5 mm) thick cut to the same cross section as the curb or curb and gutter being constructed. Templates shall be securely attached to forms to prevent movement during concrete placement.
- E. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3.02 PLACING REINFORCEMENT

- A. Comply with CRSI's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified. Field bending of any reinforcing bar is not permitted.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, oil, concrete splatter from previous pours, and other materials which inhibit or prevent bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations in accordance with CRSI Manual of Standard Practice. Locate and support reinforcing by metal or plastic chairs, runners, bolsters, spacers, and hangers, as required.
- D. Install welded wire fabric of same gage in as long of lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps of adjacent widths to prevent continuous laps in either direction.
- E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, stone, broken block or pieces of concrete, etc.
- F. Provide minimum cover for reinforcement of cast-in-place concrete, unless otherwise indicated.

1. Concrete cast against and permanently exposed to earth that is a minimum 3 in. (76.2 mm) Concrete in depth or width exposed to earth or weather

#6 and larger	2 in. (50.8 mm)
#5 and smaller	1-1/2 in (38.1 mm)

2. Concrete not exposed to weather or in contact with earth Slabs

Walls, Joists	3/4 in. (19 mm)
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Beams, Columns

1-1/2 in (38.1 mm)

3.03 JOINTS**A. Construction Joints**

1. Locate construction joints on slab floor, which are not shown on drawings, and notify Engineer for approval.
2. Provide keyways at least 1-1/2" (38.1 mm) deep in construction joints in walls and between walls and footings; accepted preformed keyways designed for this purpose may be used for slabs.
3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints unless otherwise noted on drawings.

B. Isolation Joints: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and foundations as shown on drawings. Unless otherwise indicated, install 90# felt paper between slab and vertical surface.**C. Contraction (Control) Joints**

1. Contraction Joints in interior Slabs-on-Ground: Sawcut contraction joints in slabs-on-ground to form panels of patterns as shown. Sawcuts shall be made as soft cuts. Joints shall be cut with the use of appropriate equipment within a time frame that will prevent drying shrinkage cracks (typically between 1 and 12 hours after slab finishing is complete depending on type of equipment used, site conditions, and composition of the place concrete) in strict accordance with the recommendations included in ACI 302.1. Joints shall be 1/8" wide and 1/4 the depth of the slab.
2. Walks: Construct contraction joints to form panels of patterns as shown. Joints shall be made at regular intervals along the line of the work. On straight work, the joints shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be along lines concentric with and radial to the proportion of the work in which they are placed. The markings shall be made with jointer tools that will round the edges of the scoring lines to a radius of 1/8 inch (3.2 mm), with a depth of not less than 1 1/4 inch (31.75 mm). The finished joint opening, exclusive of radii, shall not be wider than 1/8 inch (3.2 mm).

D. Expansion Joints

1. Slabs-on-Ground: Expansion joint material shall be placed around utility access openings within the slab, including clean outs and utility valves, and between new concrete slab and adjacent masonry. Joint material shall be 1/2 inch (12.7 mm) thick, pre-molded, asphalt impregnated complying with ASTM D1751 and extend the full depth of the concrete.
2. Curbs and Gutters: Construct 1/2 inch (12.7 mm) joints in curbs and gutters at the end of all returns except where cross gutters are being constructed. They shall be at the ends of the cross gutter transitions and also along the line of work at regular intervals, not to exceed 36 feet

(10.97 m). Joints in gutter shall be continuous with those in adjacent curb.

3. Walks: Place joints in walks, between walk and a building or structure, in walk returns, and between the walk and the back of the curb returns. Expansion joints shall be in accordance with the expansion joint detail shown on the drawings. Where sidewalk abuts curb, joint filler strips between walk and curb shall be the full depth of the walk with the top of the filler strip set flush with the top of the curb. Transverse sidewalk joints shall not exceed 30 feet (9.14 m) spacing. Joint material shall be 1/2 inch (12.7 mm) thick.

3.04 PREPARATIONS FOR PLACING CONCRETE

- A. Water, debris, and all loose material shall be removed from excavations. Wood chips, shavings, and hardened concrete shall be removed from the forms before any concrete is placed. All equipment shall be cleaned. Forms shall be wetted, except in freezing weather, or oiled.
- B. The earth shall be uniformly moistened only when directed in writing by the referenced project Geotechnical Engineer prior to placing concrete.. The method of sprinkling shall not be such as to form mud or pools of water. Watering the subgrade immediately prior to placing the concrete is not sufficient to make the soil uniformly moist.
- C. Notify other crafts to permit installation of their work. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- D. All rigid utility pipes penetrating forms (earth formed and otherwise) for concrete grade beams and footings shall be wrapped with 1/2" thick compressible material for the entire surface area of pipe to be encased with concrete. The compressible material shall be secured in a manner to prevent displacement due to placement of concrete.

3.05 PLACING CONCRETE

- A. Field Observation
 1. Concrete shall not be placed until forms and reinforcing steel have been observed by the project Structural Engineer and until the soil conditions have been approved by the referenced Geotechnical Engineer. The respective Engineers shall receive written notification of the Contractor's request to place concrete no less than five (5) business days before placement is scheduled to occur.
 2. Ready-Mix concrete shall be placed within a specified delivery time based upon the following atmospheric temperature conditions:
 - Below 40°F (4.4° C) see cold weather placing
 - 40°-85°F (4.4 - 29.4° C) 90 minutes
 - 86°-90°F (30° - 32.2° C) 75 minutes
 - above 90°F (32.2° C) 60 minutes

Concrete exceeding delivery time may be rejected by the Engineer or Owner.

- B. General: Comply with ACI 304, and as herein specified. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. A copy of every truck delivery ticket showing amount of water, time batched, time placed, placement location, approved discharge site name and location, and revolutions shall be provided to Owners representative at completion of the pour. Any concrete not meeting these specifications is subject to removal and replacement by General Contractor at their expense.
- C. Placing Concrete in Forms
1. Deposit concrete in forms in horizontal layers not deeper than 24" (609.6 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 2. Consolidate placed concrete by high frequency mechanical vibrating equipment, supplemented, as necessary, by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" (152.4 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
 4. Concrete shall not be allowed to free fall more than 5 feet (1.52 m) unless confined by a closed chute, except that concrete being placed in walls 10 inches (254 mm) or less in thickness may free fall a maximum of 8 feet (2.44 m).
 5. Reinforcing bars are to be chaired off the exterior of the form and have minimal clearance specified prior to placement. Concrete shall be placed by use of a "Tremie" and shall not be allowed to change the position of the reinforcing steel.
- D. Application of Under Slab Vapor Retarder
1. Install retarder in strict accordance with the manufacturer's written instructions.
 2. Place retarder over subgrade/subbase (immediately below slab) with the longest dimension parallel with the longest slab pour dimension.
 3. Seal retarder continuous to foundation walls and extend 6" minimum into turned down slab foundation excavations.

4. Overlap retarder material joints 6 inches minimum and seal with manufacturer's tape.
 5. Seal all penetrations with retarder material and seal tape.
 6. Replace damaged retarder with retarder material or as instructed by the manufacturer. Lap material 6 inches beyond damaged areas and seal as prescribed for seam joints.
- E. Placing Concrete Slabs
1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 2. Bring slab surfaces to correct level as above, and use bull floats or darbies to smooth surface, free of humps or hollows. Do not use tools (i.e., jitterbugs) that force the aggregate away from the surface.
 3. Maintain reinforcing in proper position during concrete placement operations.
- F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures; comply with ACI 306 and these specifications.
1. Concrete shall be mixed and placed only when the atmospheric temperature is at least 40°F (22°C) and rising unless permission to pour is obtained from the Engineer.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.
 4. When approval is obtained to place concrete at or below an atmospheric temperature of 40°F (22° C), the water or aggregates, or both, shall be heated, and suitable enclosures and heating devices shall be provided. The mixed concrete shall have a temperature of at least 50°F (28° C) and not more than 90°F (50° C) at the time of placing. The heating equipment or methods shall be capable of heating the water and aggregates uniformly, and these materials shall not be heated to a temperature exceeding 150°F (83° C).
 5. After any concrete is placed, the Contractor shall provide suitable measures to maintain a concrete surface temperature of 40°F (22°C) or above for a period of not less than 7 days.
- G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (50°C). If ice or cold water is required then it will be at Contractors expense and must have prior approval by Owner and Engineer.

2. Cover reinforcing steel with water-soaked burlap when required to ensure that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Wet forms thoroughly before placing concrete.
4. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions. Prior approval is required.

3.06 CONCRETE FINISHING

A. General

1. Do not use tools (i.e., jitterbugs) that force the aggregate away from the surface.
2. Water shall not be sprayed or sprinkled onto a concrete surface to aid in finishing.
3. The finisher should avoid bringing more water than necessary to the surface and avoid working the surface any more than necessary to obtain the required finish.

B. Slab Finishes

1. Float Finish: Apply float finish to slabs for driveways, exterior slabs, curbs and gutters and interior floor slabs receiving additional covering. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small. Slab surface tolerance shall have a specified F_F of 20 and F_L of 15 in accordance with ACI 302 and ACI 117.
2. Trowel Finish: Apply trowel finish to interior exposed floors. After floating, begin first trowel finish operation. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, and uniform in texture and appearance. Slab surface shall have a specified F_F of 20 and F_L of 15 in accordance with ACI 302 and ACI 117.
3. Medium Broom: For sidewalks apply trowel finish as specified above. Immediately follow with slightly scarifying surface by fine brooming perpendicular to main traffic route.

C. Finish of Formed Surfaces

1. Grout-Cleaned Finish: The entire surface of all exposed exterior concrete shall be given a rubbed grout clean-down finish using a mix of one part white Portland cement and 1-1/2 parts of fine sand mixed with sufficient water to form a grout having the consistency of thick paint. Apply to damp surface and rub down in such a manner as to obtain a smooth, filled surface uniform in color and free from defects and blemishes.

2. Smooth Rubbed Finish: Interior exposed surfaces (where scheduled to be painted) shall be rubbed with carborundum stones and water to a smooth, even surface for painting.

3.07 CONCRETE CURING

- A. General: Immediately after placing or finishing, and as soon as the operation will not mar the finish, concrete surfaces not covered by forms shall be protected against moisture loss. Curing shall be accomplished by one of the following methods or a combination thereof, as approved and such protection shall be maintained for a period of at least 7 days. Where formed surfaces are cured in the forms, the forms shall be kept continually wet. If the forms are removed before the end of the curing period, curing shall be continued as on unformed surfaces, using curing materials specified herein. Surfaces shall be kept free of foot and vehicular traffic during the curing period.
- B. Curing Methods
 1. Polyethylene Coated Burlap Mats: Surfaces shall be covered with the specified mat lapped 12 inches (304.8 mm). The mat shall be weighted to prevent displacement. Tears or holes shall be immediately repaired by patching.
 2. Membrane Forming Curing Compound: This compound shall be applied in a two coat continuous operation, using not less than the manufacturer's recommended rate of application. If unknown, it shall be applied at 1 gallon (3.79 liters) per 200 square feet (18.58 square meters) for each coat. Surfaces damaged by construction operations during curing shall be re-sprayed at the same rate. Curing compound, if used, shall be compatible with the floor sealer specified in Section 03012.
 3. Water Curing: Water curing shall be used on surfaces that are to receive additional concrete or concrete fill, dust-proofing and hardening treatments, stucco, plaster, or painting.

3.08 REMOVAL OF FORMS

- A. The forms for any portion of the structure shall not be removed until the concrete is strong enough to not be damaged when the forms are removed.
- B. If field operations are not controlled by cylinder tests, the following periods, exclusive of days when the temperature is below 40°F (4.4°C), may be used as a guide for removal of forms and supports:

Centering under beams	14 days
Elevated floor slabs	14 days
Walls	24 hours
Columns	7 days
Sides of beams & other parts	24 hours

- C. If field operations are controlled by beam or cylinder tests, forms may be removed from centering under beams and floor slabs when a 2500 psi (175.77 kgs-sq cm) compressive strength is attained, and it is approved by the Engineer of Record.
 - 1. Superimposed loads shall not be placed on or against load carrying members until a 2500 psi (175.77 kgs-sq cm) compressive strength has been attained and it is approved by the Engineer.

3.09 REUSE OF FORMS

- 1. Clean and repair surfaces of forms to be reused in work. The shape, strength, rigidity, water-tightness, and surface smoothness of reused forms shall be maintained at all times. Any warped or bulged lumber shall be re-sized before being used. Unsatisfactory forms shall not be used.

3.10 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Immediately after removing forms, cut back form ties and remove all fins and loose material. Honeycombs and voids shall be cut to solid concrete, thoroughly wetted, and filled with cement mortar composed of one part cement to three parts sand.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Inspector. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie-holes; fill with dry-pack mortar.
- C. Repair of Slabs-on-Ground: Test surfaces for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low areas, if approved by Owner, during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when accepted per 1.04 of this specification. Correct high areas in slabs by grinding after concrete has cured at least 14 days.

3.11 CONCRETE TRUCK DISCHARGE

- A. Approved Discharge Site: All concrete wash water shall be discharged in an approved concrete disposal site such as a concrete recycling center, construction material landfill authorized to accept such material, or the concrete production facility. It is the responsibility of the General Contractor to verify that the concrete producer has secured an approved discharge site for all concrete waste material.
- B. Excess Concrete: Excess concrete in mixer trucks that cannot be immediately used shall be discharged to an area where it will not create an obstruction or hazard during construction. This concrete shall be removed from the site in a

timely manner to a site approved by the Engineer of Record at the General Contractors cost.

- C. Wash Water Discharge: Wash water from mixer trucks shall be discharged to the ground surface in such a manner and at such a location that discharge cannot escape the construction site or be washed away to arroyos, lakes, storm sewers, or sanitary sewers by precipitation or other surface flows. Location of wash out areas to be approved by Owner prior to initial use. Prior to project completion, wash water residue shall be removed from the site to a location approved by the Engineer of Record and the wash water discharge site shall be cleaned free of debris at General Contractors cost.

END OF SECTION

**SECTION 04731
QUARTZ SURFACE FABRICATIONS**

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes the following horizontal and trim quartz surface product types:
 - 1. Countertops with sinks.
 - 2. Vanity tops with under-mount bowls.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for Blocking.
 - 2. Division 6 Section "Solid Surface Fabrications."
 - 3. Division 15 Section "Plumbing Fixtures."

1.02 SUBMITTALS

- A. Samples: Two 2" x 2" samples of each color from manufacturer's stock colors (if requested by Owner).

1.03 QUALITY ASSURANCE

- A. Applicable standards:
 - 1. Fire test response characteristics:
 - a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E 84) or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Flame Spread Index: 25 or less.
 - c. Smoke Developed Index: 450 or less.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 - 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.05 WARRANTY

- A. Provide manufacturer's 10-year warranty against defects in materials.
 - 1. Warranty shall provide material to repair or replace defective materials.

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

A. Provide as indicated on the Drawings.

2.02 MATERIALS

A. Material:

1. Homogeneous quartz surfaces material.
2. Material shall have minimum physical and performance properties specified.

B. Performance characteristics: physical properties data sheet:

Property	Typical Results	Test Procedure
Flexural Strength	>5,300 psi	ASTM D 790
Flexural Modulus	5.3–5.7E ⁶ psi	ASTM D 790
Flexural Elongation	>0.1%	ASTM D 790
Compressive Strength (Dry)	~27,000 psi	ASTM C 170
Compressive Strength (Wet)	~24,000 psi	ASTM C 170
Hardness	7	Moh's Hardness Scale
Thermal Expansion	1.45 x 10 ⁻⁵ in./in./°C	ASTM D 696
Gloss (60°)	45-50	ANSI Z 124
Colorfastness	Passes	ANSI Z 124.6.5.1
Wear and Cleanability	Passes	ANSI Z 124.6.5.3
Stain Resistance	Passes	ANSI Z 124.6 (stain 5.2, chemical 5.5, cigarette 5.4 resistances)
Fungal and Bacterial Resistance	No Growth	ASTM G 21 & G22
High Temperature Resistance (356°)	None to slight effect	NEMA LD 3.3.6*
Boiling Water Resistance	None to slight effect	NEMA LD 3.3.5*
Freeze-Thaw Cycling	Unaffected	ASTM C 1026
Point Impact	Passes	ANSI Z 124.6.4.2
Ball Impact	164 inches	NEMA LD 3.3.8*
Slip Resistance	Above 0.80 for textured models	ASTM C 1028
Static Coefficient of Friction (as received)	0.89/0.61 (wet/dry)	ASTM C 1028

Static Coefficient of Friction (with renovator)	0.87/0.65 (wet/dry)	ASTM C 1028
Abrasion Resistance	139	ASTM C 501
Specific Gravity	2.44	ASTM D 792
Density	~2400 kg/m ³	
Water Absorption	0.12%	ASTM C 373
Long- and Short-Term	<0.04%	ASTM D 570
Moisture Expansion	<0.01% on average	ASTM C 370
Toxicity	Passes, LC50=68-128	Pittsburgh Protocol
Flammability	For all colors tested (Class I and Class A)	ASTM E 84, UL 723 & NFPA 255
Flame Spread Index	FSI<10 for 3 cm and <15 for 2 cm	
Smoke Developed Index	SDI<50 for 3 cm and <100 for 2 cm	
Nominal Thickness	2 cm and 3 cm	
Nominal Weight	10 lb./ft. ² (2 cm) 15 lb./ft. ² (3 cm)	
*NEMA results based on the NEMA LD 3-2000		

2.03 ACCESSORY PRODUCTS

- A. Joint adhesive:
 - 1. Manufacturer approved adhesive to create color-matched seam.
- B. Sink/bowl mounting hardware:
 - 1. Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of under-mount sinks/bowls.

2.04 FINISHES

- A. Color as indicated on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install components plumb and level, in accordance with approved shop drawings and product installation details.
 - 1. Tops:

- a. Flat and true to within 1/8" (3 mm) of a flat surface over a 10' length.
 - b. Allow a minimum of 1/16" to a maximum of 1/8" (3 mm) clearance between surface and each wall.
- B. Form field joints using manufacturer's recommended adhesive, with joint widths no greater than 1/8" (3 mm) in finished work.
 - 1. Keep components and hands clean when making joints.
- C. Sinks:
 - 1. Adhere under-mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
 - 2. Adhere drop-in sinks/bowls to countertops using manufacturer-recommended adhesives and color-matched silicone sealant.
- D. Provide backsplashes and end splashes as indicated on the drawings.
 - 1. Adhere to countertops using manufacturer's standard color-matched silicone sealant.
- E. Keep components and hands clean during installation.
 - 1. Remove adhesives, sealants and other stains.
 - 2. Components shall be clean on date of substantial completion.
- F. Connections:
 - 1. Make plumbing connections in accordance with Division 15.
 - 2. Make electrical connections in accordance with Division 16.

3.02 CLEANING AND PROTECTION

- A. Keep components clean during installation.
 - 1. Remove adhesives, sealants and other stains.
- B. Protect surfaces from damage until date of substantial completion.
 - 1. Replace damaged work.

END OF SECTION

**SECTION 06050
FRAMING CARPENTRY**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Sub-flooring.
 - 2. Wood blocking and furring.
 - 3. Telephone and electrical panel backboards.
 - 4. Preservative treatment of wood.

1.02 REFERENCES

- A. American Lumber Standards Committee (ALSC).
- B. American Society for Testing and Materials (ASTM):
 - 1. C 79 - Gypsum Sheathing Board.
 - 2. D 226 - Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
- C. American Wood Preservers Association (AWPA):
 - 1. U1-11 – User Specification for Treated Wood.
 - 2. T1-11 – Processing & Treatment Standard
 - 3. E72 – Methods if Conducting Strength Tests of Panels for Building Construction.
- D. American Wood Preservers Bureau (AWPB) - Quality Control Standards.
- E. Engineered Wood Association (APA):
 - 1. Grading Rules.
 - 2. PRP-1 08 - Performance Standards and Policies for Structural-Use Panels.
- F. National Institute of Standards and Technology (NIST) - Product Standards:
 - 1. PS 1 - Construction and Industrial Plywood.
 - 2. PS 2 - Wood-Based Structural-Use Panels.
 - 3. PS 20 - American Softwood Lumber Standard.
- G. AFPA-NDS Specification for Wood Construction Design Values for Wood Construction.
- H. HPMA-SG Structural Design Guide for Hardwood Plywood Wall Panels
- I. ASTM D1761 Test Methods for Mechanical Fasteners in Wood

1.03 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Panel Products: Certified by APA.
- C. Identify lumber and panel products by official grade mark.
- D. Preservative Treated Products: Identify by AWP13 quality mark.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials minimum 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation.
- B. Do not store seasoned or treated materials in damp location.
- C. Protect edges of sheet materials from damage to corners.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Furnished by a recognized Lumber Supply Yard Supplier.
- B. Lumber specified should be #2 or better with moisture content $\leq 19\%$.

2.02 ACCESSORIES

- A. Hardware: Type and size as required by conditions of use; galvanized steel for exterior use, plain steel for interior use.
- B. Framing Connectors: Galvanized steel sized and shaped to suit framing conditions.

2.03 FABRICATION

- A. Preservative Treatment:
 - 1. Treat wood in contact with cementitious materials.
 - a. Lumber: Treat in accordance with AWWA U1-11, Commodity Specification "A" use category 4C using waterborne preservative.
 - b. Panel products: Treat in accordance with AWWA U1-11, Commodity Specification "F" use category 4B using waterborne preservative.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set structural members level and plumb, in correct position.
- B. Make provisions for erection loads, and for temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Place beams, joists, and rafters with crown edge up.
- D. Construct load bearing framing member's full length without splices.
- E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- F. Stud Framing:
 - 1. Provide single bottom plate (or double bottom plate where 1-1/4 in. Gypcrete is required) and double top plates for load bearing partitions.

2. Provide single bottom plate (or double bottom plate where 1-1/4 in. Gypcrete is required) and single top plate for non load bearing partitions.
 3. Anchor bottom plates to concrete structure.
 4. Triple studs at corners and partition intersections.
 5. Anchor studs abutting masonry or concrete with toggle or expansion bolts.
 6. Frame openings with double studs and headers. Space short studs over and under opening to stud spacing.
- G. Joist Framing:
1. Provide minimum 1-1/2 inches of bearing.
 2. Lap members framing from opposite sides minimum 4 inches.
 3. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists.
 4. Bridge joists in excess of 8 feet span at mid span.
- H. Rafter Framing:
1. Notch to fit exterior wall plates.
 2. Double rafters at roof openings; support with metal hangers.
 3. At ridge, place rafters directly opposite each other and secure to ridge member.
 4. At hips and valleys, bevel ends for bearing against hip or valley rafter.
 5. Locate collar ties at every third pair of rafters, one third of the distance to ceiling joists; cut ends to fit slope and secure to rafters.
- I. Beams:
1. Notch to fit exterior wall plates. Provide minimum end bearing of 4 inches.
 2. Nail built-up members with 2 rows of nails spaced 6 inches on center maximum.
- J. Roof Sheathing:
1. Place panels perpendicular to framing members with ends staggered and sheet ends over firm bearing.
 2. Install sheathing clips between sheets between roof framing members.
 3. Leave 1/8 inch expansion space at panel ends and edges.
 3. Secure to supports with nails spaced maximum 6 inches on center along edges and maximum 12 inches on center in field of panels. Unless noted otherwise.
- K. Gypsum Wall Sheathing:
1. Place gypsum sheathing horizontally, tongue edge up, with ends occurring supports. Stagger end joints in adjacent rows.
 2. Fasten to supports at maximum 12 inches on center along panel edges and at intermediate supports.
- L. Panel Product Wall Sheathing:
1. Place panel product sheathing at building corners for a horizontal distance of 48 inches minimum.
 2. Leave 1/8 inch expansion space at panel ends and edges.
 3. Secure to supports at maximum 6 inches on center along edges and 12 inches on center in field of panels. Unless noted otherwise.
- M. Sub-flooring:

1. Place panels perpendicular to floor framing with end joints staggered and sheet ends over firm bearing.
 2. Leave 1/8 inch expansion space at panel ends and edges.
 3. Secure to supports at maximum 6 inches on center along edges and maximum 6 inches on center in field of panels.
- N. Install plywood telephone and electrical panel boards where required. Oversize panel by 12 inches on all sides.

END OF SECTION

**SECTION 06200
FINISH CARPENTRY**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Documents affecting work of this Section include, but are not necessarily limited to, Sections in Division 1 of these Specifications.

1.02 WOOD PRODUCT QUALITY STANDARDS

- A. Softwood Lumber Standards: comply with PS-20 and with applicable grading rules of the respective grading and inspection agency for the species and product indicated.
- B. Plywood Standard: comply-with PS 1/ANSI A 199.
- C. Hardwood Lumber Standard: comply with National Hardwood Lumber Association (NHLA) rules.
- D. Hardwood Plywood Standard: comply with PS 51.
- E. Woodworking Standard: where indicated for a specific product, comply with specified provision of the following:
 - 1. Architectural Woodwork Institute (AWI) "Quality Standards"
- F. Glued-up Lumber Standard: comply with PS 56.

1.03 DELIVERY AND STORAGE

- A. Deliver lumber, plywood, trim and millwork to the jobsite in an undamaged condition.
- B. Stack materials to ensure proper ventilation and drainage and protect against dampness before, during, and after delivery.
- C. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity.
- D. Do not store materials in the building until all wet work is complete and dried out.
- E. Replace defective or damaged materials.

1.04 GRADE MARKING

- A. Lumber:
 - 1. Each piece or bundle (include millwork and wood trim) shall be identified by the grade mark of a recognized association or independent inspection agency that specializes in the particular species used. Such association or independent inspection agency shall be certified by the Board of Review, American Lumber Standards Committee to grade the species used.
- B. Plywood and Veneer Plywood

1. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark for softwood plywood shall identify the plywood by species group or identification index, and shall show glue type, grade and compliance with U.S. Dept. of Commerce, PS 1.

1.05 SIZES AND PATTERNS OF WOOD PRODUCTS

- A. Yard and board lumber sizes shall conform to U.S. Dept' Commerce PS-20 except as indicated or specified otherwise, sizes are nominal. Provide shaped lumber and millwork in the patterns indicated and which conform to standard patterns of the association recognized as covering the species used. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

1.06 MOISTURE CONTENT OF WOOD PRODUCTS

- A. Air-dry or kiln-dry lumber. The maximum moisture content of wood products at time of delivery to the jobsite shall be as follows:
 1. Interior finish lumber, trim and millwork 1-1/4" or less in nominal thickness 9%
 2. Exterior treated or untreated finish lumber and trim 4" or less in nominal thickness: 15%
 3. Moisture content of other materials shall be in accordance with the standards under which the products are produced

PART 2 – PRODUCTS

2.01 INTERIOR FINISH TRIM

- A. Standing and Running Trim:
 1. Painted Trim
 - a. Southern Yellow Pine or MDF manufactured to sizes and profiles shown from selected first grade lumber (NHLA); complying with following grade requirements of referenced woodworking standard, for quality of materials and manufacture. No finger joints will be allowed. Grade A material only.
 2. Stained Trim
 - a. Hardwood of either Maple, Birch or Alder whichever is the current lowest cost to match the wood from the cabinets manufactured to sizes and profiles shown from selected first grade lumber (NHLA); complying with following grade requirements of referenced woodworking standard, for

quality of materials and manufacture. No finger joints will be allowed. Grade A material only.

- B. Hardwood Plywood Stock Panels: Provide manufacturer's stock hardwood plywood panels complying with applicable requirements of PS 51 for species and grade of face veneers and backing, adhesive, construction, thickness, panel size and finish.
 - 1. Face Veneer Species: Alder
 - 2. Grade: Premium
 - 3. Backing Veneer Species: Any hardwood compatible, with face species.
 - 4. Thickness: 3/4" unless noted otherwise.
 - 5. Plywood Type (water resistance Capability): Type II (interior).
 - 6. Face Patterns: Plain (no grooves) with veneer edge matched within each panel face to, comply with type of match required by referenced product standard.
- C. Miscellaneous Materials: Fasteners and Anchorages: Provide dowels, nails, screws and other anchoring devices of the type, size, material and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specification.

2.02 PLASTIC LAMINATE COUNTER TOPS (when indicated on the drawings)

- A. Quality Standard: comply with AWL Section 400 and its Division 400C.
- B. Type of Top: High pressure decorative laminate
 - 1. Grade: custom
 - 2. Laminate Cladding for Horizontal Surface: High pressure Decorative laminate complying with NEMA LD 3 and as follows:
 - a. Colors and Patterns: As indicated on drawings.
 - b. Finish: As indicated on drawings.
 - 3. Edge Treatment: As indicated on drawings.
 - 4. Edge thickness: standard 1-1/2" unless noted otherwise
- C. Core Backup: 45 lb. density industrial board or B/D plywood; typical 3/4" material with double thickness at edge.

PART 3 - EXECUTION

3.01 GENERAL FINISH WORK

- A. Provide sizes, materials, and designs as indicated or as specified herein.
- B. Where practicable, assemble and finish items of built-up millwork in shop.
- C. Joints shall be tight and constructed in a manner that will conceal shrinkage.
- D. Miter trim and moldings at exterior angles and cope at interior angles and at returns.
- E. Materials shall show no excessive warp.
- F. Install millwork and trim in the maximum practical lengths.
- G. Fasten finish work with adhesive and hold in place with finish nails.
- H. Provide blind nailing where practicable.

- I. Set face nails for putty stopping.

3.02 SHELVING (when indicated on the drawings)

- A. 3/4" thick plywood shelf material supported substantially with end and intermediate supports and arranged to prevent buckling and sagging.
- B. Supports shall be steel standards, channel-shaped, with 1" adjustment slots and brackets designed for friction attachment to standards.
- C. Anchor standards to wall at not more than 16" on center.

3.03 COUNTERS (when indicated on the drawings, usually only for the Amenity Buildings)

- A. Constructed with 3/4" substrate as indicated with blocked edges in thickness noted.
- B. Conceal fastenings where practicable, fit the counter neatly, install in a rigid and substantial manner, and scribe to adjoining surfaces.
- C. Face edge and back splashes with 1/16" plastic laminate.
- D. Bond plastic laminate under pressure to particle board core or plywood with water-resistant resin adhesive.
- E. Provide counter sections in the longest lengths practical; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts.
- F. Glue joints with water resistant glue and, in addition, make rigid and substantial with screws, bolts or other approved fastenings.

END OF SECTION

**SECTION 06410
CABINETS**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section includes all casework for project.
- B. References:
 - 1. ANISI 161.1 - Minimum Construction and Performance Standards for Kitchen and Vanity Cabinets.
 - 2. ANISI/BHMA A156.9 -Cabinet Hardware.
 - 3. AWI – Quality Standards illustrated
 - 4. KCMA certification

1.02 SUBMITTALS

- A. Product Data:
 - 1. Submit product data for each casework and for each hardware type specified.
- B. Shop Drawings:
 - 1. Submit shop drawings for casework showing location and size, accessories, materials, finishes and filler panels. Include fully dimensioned plans, elevations, and anchorage details to countertop and walls. Include installation instructions.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain kitchen casework from one source from a single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver casework as a factory-assembled unit, packaged individually, and shipped each in its own carton.
- B. Deliver in unopened containers with labels clearly identifying manufacturer and product name.
- C. Storage: Store materials off ground, under cover, and protected from weather, direct sunlight, and construction activities.

1.05 PROJECT CONDITIONS

- A. Environmental Conditions:

1. Comply with casework manufacturer's recommendations for optimum temperature and humidity conditions during storage and installation. Do not install casework until these conditions have been attained.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Casework:
 1. Supplier: Qualified Millwork Contractors

2.02 MATERIALS

- A. Sizes, dimensions, and thicknesses given are minimum dimensions.
- B. Particleboard:
 1. ANSI A208.1, mat-formed particleboard, Grade 1-M-2 with minimum density of 40 pcf, internal bond of 60 psi, and minimum screw-holding capacity of 225 lbs. on faces and 200 lbs. on edges.
- C. Hardwood Plywood:
 1. ANSI/HPMA HP hardwood and decorative plywood, Good Grade (1) or better, of thickness, species, and cut.
- D. Particleboard-Core Plywood:
 1. ANSI/HPMA HP hardwood and decorative plywood, Good Grade (1) or better, of thickness, species, and cut.
- E. Solid Wood:
 1. Clear, dry, sound, and free of defects selected from First Grade lumber as defined by NHLA. 2. Provide solid wood of the following species:
 - a. Red Oak
 - b. White Oak
 - c. Cherry
 - d. Maple
- F. Hardboard:
 1. ANSI A135.4, Class 1, tempered.

2.03 CASEWORK HARDWARE

- A. General:
 1. All hinges are heavy duty 6 way adjustable concealed hinges with self closing feature.
 2. Drawer Guides – Under mount, steel 100 # rated load capacity, full extension and soft close feature (automatically retracts last 2 inches).

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Casework Installation:
 - 1. Install casework with no variations in flushness of adjoining surfaces, using concealed shims where casework abuts other finished work, scribe, and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.
 - 2. Install casework without distortion so that doors and drawers fit openings properly and are aligned. Adjust hardware to provide unencumbered operation. Use concealed joint fasteners to align and secure adjoining cabinet units. Complete the installation of hardware and accessories as indicated.
 - 3. Install casework level and plumb to a tolerance of 1/16 inch in 8 feet.
 - 4. Fasten unit of casework to adjacent unit and into structural supports members of wall construction with #10 sheet metal or wood screws with washer head or washer.
- B. Countertop Installation:
 - 1. Fasten plastic laminate countertops by screwing through corner blocks in base units into underside of countertop. Spline and glue joints in countertops and provide concealed mechanical clamping of joint.
 - 2. Fasten filled-polymer countertops by screwing through corner blocks in base units into underside of countertop. Align adjacent surfaces. Form seams 1/8-inch wide and adhere with manufacturer's recommended joint adhesive in color to match countertop.

3.02 ADJUSTING AND CLEANING

- A. Adjust hardware to center doors and drawers in openings and lubricate to provide unencumbered operation.
- B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 06410 CABINETS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section includes pre-manufactured kitchen and bath cabinets.
- B. References:
 - 1. ANISI 161.1 - Minimum Construction and Performance Standards for Kitchen and Vanity Cabinets.
 - 2. ANISI/BHMA A156.9 -Cabinet Hardware.
 - 3. AWI – Quality Standards illustrated
 - 4. KCMA certification

1.02 SUBMITTALS

- A. Product Data:
 - 1. Submit product data for each casework and for each hardware type specified.
- B. Shop Drawings:
 - 1. Submit shop drawings for casework showing location and size, accessories, materials, finishes and filler panels. Include fully dimensioned plans, elevations, and anchorage details to countertop and walls. Include installation instructions.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain kitchen casework from one source from a single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver casework as a factory-assembled unit, packaged individually, and shipped each in its own carton.
- B. Deliver in unopened containers with labels clearly identifying manufacturer and product name.
- C. Storage: Store materials off ground, under cover, and protected from weather, direct sunlight, and construction activities.

1.05 PROJECT CONDITIONS

- A. Environmental Conditions:

1. Comply with casework manufacturer's recommendations for optimum temperature and humidity conditions during storage and installation. Do not install casework until these conditions have been attained.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Kitchen Casework:
 1. Supplier is Armstrong Cabinets. Contact Steve Ingersoll at 972-834-3238 for more information.

2.02 MATERIALS

- A. Sizes, dimensions, and thicknesses given are minimum dimensions.
- B. Particleboard:
 1. ANSI A208.1, mat-formed particleboard, Grade 1-M-2 with minimum density of 40 pcf, internal bond of 60 psi, and minimum screw-holding capacity of 225 lbs. on faces and 200 lbs. on edges.
- C. Hardwood Plywood:
 1. ANSI/HPMA HP hardwood and decorative plywood, Good Grade (1) or better, of thickness, species, and cut.
- D. Particleboard-Core Plywood:
 1. ANSI/HPMA HP hardwood and decorative plywood, Good Grade (1) or better, of thickness, species, and cut.
- E. Solid Wood:
 1. Clear, dry, sound, and free of defects selected from First Grade lumber as defined by NHLA. 2. Provide solid wood of the following species:
 - a. Red Oak
 - b. White Oak
 - c. Cherry
 - d. Maple
- F. Hardboard:
 1. ANSI A135.4, Class 1, tempered.

2.03 CASEWORK HARDWARE

- A. General:
 1. All hinges are heavy duty 6 way adjustable concealed hinges with self closing feature.
 2. Drawer Guides – Under mount, steel 100 # rated load capacity, full extension and soft close feature (automatically retracts last 2 inches).

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Casework Installation:
 - 1. Install casework with no variations in flushness of adjoining surfaces, using concealed shims where casework abuts other finished work, scribe, and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.
 - 2. Install casework without distortion so that doors and drawers fit openings properly and are aligned. Adjust hardware to provide unencumbered operation. Use concealed joint fasteners to align and secure adjoining cabinet units. Complete the installation of hardware and accessories as indicated.
 - 3. Install casework level and plumb to a tolerance of 1/16 inch in 8 feet.
 - 4. Fasten unit of casework to adjacent unit and into structural supports members of wall construction with #10 sheet metal or wood screws with washer head or washer.
- B. Countertop Installation:
 - 1. Fasten plastic laminate countertops by screwing through corner blocks in base units into underside of countertop. Spline and glue joints in countertops and provide concealed mechanical clamping of joint.
 - 2. Fasten filled-polymer countertops by screwing through corner blocks in base units into underside of countertop. Align adjacent surfaces. Form seams 1/8-inch wide and adhere with manufacturer's recommended joint adhesive in color to match countertop.

3.02 ADJUSTING AND CLEANING

- A. Adjust hardware to center doors and drawers in openings and lubricate to provide unencumbered operation.
- B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

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**SECTION 06651
SOLID SURFACE FABRICATIONS**

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes the following horizontal and trim solid surface product types:
 - 1. Countertops with sinks.
 - 2. Vanity tops with under-mount bowls.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for Blocking.
 - 2. Division 15 Section "Plumbing Fixtures."

1.02 DEFINITION

- A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.03 SUBMITTALS

- A. Samples: Two 2" x 2" samples of each color from manufacturer's stock colors (if requested by Owner).

1.04 QUALITY ASSURANCE

- A. Applicable standards:
 - 1. Fire test response characteristics:
 - a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Flame Spread Index: 25 or less.
 - c. Smoke Developed Index: 450 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 - 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.06 WARRANTY

- A. Provide manufacturer's warranty against defects in materials.
 - 1. Warranty shall provide material and labor to repair or replace defective materials.
- B. Manufacturer's warranty period:
 - 1. Ten years from date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. The Drawings were prepared and this specification written on the basis of using the products of Living Stone® . **Preferred vendor, no substitutions allowed.**

2.02 MATERIALS

- A. Solid polymer components
 - 1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
 - 2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
- B. Performance characteristics:

Property	Typical Results	Test Procedure
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5×10^{-6} psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2×10^{-6} psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale ASTM D 785
	56	Barcol Impressor ASTM D 2583
Thermal Expansion	3.02×10^{-5} in./in./°C (1.80×10^{-5} in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6

Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact Resistance: Sheets	No fracture—1/2 lb. ball: 1/4" slab—36" drop 1/2" slab—144" drop	NEMA LD 3-2000 Method 3.8
Weatherability	$\Delta E^*_{94} < 5$ in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	
Water Absorption	Long-term 0.4% (3/4") 0.6% (1/2") 0.8% (1/4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburgh Protocol Test ("LC50" Test)
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	
† Approximate weight per square foot: 1/4" (6 mm) 2.2 lbs., 1/2" (12.3 mm) 4.4 lbs.		

2.03 ACCESSORIES

- A. Joint adhesive:
 - 1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.
- B. Sealant:
 - 1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.
- C. Sink/lavatory mounting hardware:
 - 1. Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of under-mount sinks/lavatories.
- D. Conductive tape:
 - 1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

- E. Insulating felt tape:
 - 1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.04 FINISHES

- A. Color: Reference drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 1. Provide product in the largest pieces available.
 - 2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams shall not be allowed.
 - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
 - 4. Cut and finish component edges with clean, sharp returns.
 - 5. Rout radii and contours to template.
 - 6. Anchor securely to base cabinets or other supports.
 - 7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - 8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

3.02 CLEANING AND PROTECTION

- A. Keep components clean during installation.
 - 1. Remove adhesives, sealants and other stains.
- B. Protect surfaces from damage until date of substantial completion.
 - 1. Replace damaged work.

END OF SECTION

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SECTION 07110
SHEET MEMBRANE WATERPROOFING
Horizontal Wood Substrates Only

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Rubberized asphalt sheet membrane waterproofing system
- B. Protection Board

1.02 RELATED SECTIONS

- A. Section 03300 – Cast-In-Place Concrete
- B. Section 07210 – Insulation
- C. Section 07610 – Metal Roofing
- D. Section 07900 – Joint Sealers
- E. Section 08100 – Steel Doors & Frames
- F. Section 08150 – Fiberglass & Composite Wood Doors/Frames
- G. Section 08500 – Vinyl Window
- H. Section 09260 – Gypsum Board

1.03 REFERENCES

- A. ANSI/ASTM D412 Tests for Rubber Properties in Tension
- B. ANSI/ASTM E96 Tests for Water Vapor Transmission of Materials in Sheet Form.
- C. ANSI/ASTM C386 Test Method for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- D. ANSI/ASTM E154 Testing Materials for use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.
- E. ANSI/ASTM D5385 Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard information on membrane waterproofing installation instructions and product data.
- B. Samples:
 - 1. Waterproofing membrane: Submit 3 x 4 inch sample
 - 2. Protection Board: Submit representative sample

1.05 QUALITY ASSURANCE

- A. Qualifications: Applicator shall be a company specializing in the work of this Section and approved by the waterproofing membrane manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in the manufacturer's original containers, dry and undamaged, seals and labels intact.
- B. Store products in weather protected environment out of direct sunlight, below 90° F, above 32° F clear of ground and moisture. All waterproof tarps shall be opaque.
- C. Do not double stack pallets.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply waterproofing membrane during inclement weather, to a damp or frosty surface, or when ambient temperatures are below 35° F or above 90° F.

1.08 PRE-INSTALLATION CONFERENCE

- A. Convene prior to commencing work of this Section. Meet at project site with installer, sheet membrane waterproofing manufacturer, installers of related work and the SRI Project Manager.
- B. Review installation procedures and coordination required with related work.

1.09 WARRANTY

- A. Provide manufacture's standard written 5 year limited material warranty upon completion of the work.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. TW-60 waterproofing membrane as manufactured by:
TAMKO Roofing Products, Inc.
P.O. Box 1404
220 W. 4th Street
Joplin, MO 64801.

2.02 MASTIC

- A. TAMKO TWM-1 Mastic

2.03 PRIMERS

- A. TAMKO TWP-1 Quick Dry Primer

2.04 SEALANT

- A. Single component polyurethane sealant

2.05 PROTECTION BOARD

- A. TWH-1 Protection Course for horizontal applications
- B. For vertical protection, follow manufactures recommendations

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that surfaces and site conditions are ready to receive work. Do not start work until all defects have been corrected.

3.02 PREPARATION

- A. Preparation of the surface shall be done in accordance with the sheet membrane manufacture's written instructions. Surfaces shall be clean, smooth, free of depressions, waves, projections, voids, spalled areas, holes (tie rod or rock pockets, spatters, ridges and loose aggregate. Any contaminants shall be removed such as grease, oil and wax.
- B. Concrete must be properly cured and dry. Curing time is a minimum of 7 days for normal structural concrete and a minimum of 14 days for lightweight structural concrete. Only self dissipating curing compounds acceptable to the waterproofing membrane manufacturer shall be used. Resin type curing compounds shall not be used.
- C. All concrete surfaces shall have a smooth finish (broom finish is not acceptable).
- D. Removable forms shall be removed as soon as possible. Membrane must not be applied to decks with forms in place, unless the forms are vented.
- E. Grind irregular construction joints and high spots off to a suitable flush surface.
- F. Cracks greater than 1/16" in width shall be cut to a minimum width of 1/4" with a minimum depth of 1/4", sealed using polyurethane sealant prior to the installation of sheet membrane.

3.03 PRIMING

- A. Quick Dry Primer: Apply primer to a properly prepared, clean surface. All surfaces that are to receive a waterproofing membrane shall be primed at the rate of 250 to 300 ft² per gallon. Apply an even coat, and allow to dry. Refer to manufacturers written application instructions for specific rates and drying time.

3.04 APPLICATION

- A. Horizontal: Starting at the low point of the surface and working to the high point, install the sheet waterproofing membrane by simultaneously rolling the sheet

into place while pulling and rolling the release paper. Side laps shall be a min. 2.5", and end laps shall be a min. 5". Stagger all end laps. All terminating edges shall be sealed with mastic. Check that the seams are firmly sealed and there are no gaps or fish mouths.

- B. Vertical: Apply membrane in lengths not to exceed 8'. Start at the lowest point with the top section overlapping the bottom section by a minimum of 5". If the membrane is terminated on a vertical surface a reglet or counter flashing shall be used. Apply TWM-1 mastic to all terminations.

3.05 FLOOD TEST

- A. Before the application of a protection layer, all horizontal applications shall be flood tested with a minimum of 2" head of water for 24 hours.
- B. Check for leaks and make repairs immediately. Before flood testing, be sure the structure is capable of withstanding the dead load of the water. Retest after repairs have been made.

3.06 MEMBRANE PROTECTION

- A. Vertical surfaces shall be protected immediately following installation of the membrane.
- B. Horizontal surfaces shall be protected immediately following the 24 hour flood test. If the flood test is delayed, a temporary protection layer must be installed to protect the membrane from future operations and other trades.

3.07 CLEAN UP

- A. In areas where adjacent finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions. Remove all debris, tools and equipment.

END OF SECTION

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SECTION 07210 INSULATION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Documents affecting work of this Section include, but are not necessarily limited to, Sections in Division 1 of these Specifications.

1.02 STANDARDS

- A. Products supplied must meet the Building Code standards (ICBO, BOCA, and SBCCI) applicable in local jurisdiction.

PART 2 – PRODUCTS

2.01 BLANKET INSULATION

- A. Fiberglass Thermal Insulation in fill 6" thick by 16" or 24" roll widths as required for stud spacing. Install where noted in on drawings. Thermal Resistance at all exterior walls as indicated on the drawings.
- B. Accepted Manufacturers: CertainTeed, Owens-Corning
- C. ROXUL AFB® (Acoustical Fire Batt) batt insulation in fill thickness as indicated on the drawings by 16" or 24" widths as required for spacing. Install where noted in on drawings.

2.02 BLOWN INSULATION

- A. Mineral or glass fiber type blown-in product. Distribute insulation blown in place by pneumatic equipment measured by coverage per bag, minimum weight per sq. ft. and minimum depth as required to attain manufacturer's calculated insulation value. Thermal Resistance in attic: As indicated on the drawings.
- B. Manufacturers: Owens-Corning "Fiberglass", CertainTeed "Insul-Safe HI", or approved equal.

2.03 ACOUSTIC INSULATION IN INTERIOR WALLS & CEILINGS

- A. Mineral Fiber Thermal Insulation in fill 3" thick by 16" or 24" roll widths as required for stud spacing. Install where noted in on drawings.
- B. Accepted Manufacturers: CertainTeed, Owens-Corning

2.04 EXPANDING FOAM INSULATION

- A. Provide for incidental filling of voids in the acoustical or thermal insulative envelopes generally defined by the Wall Schedule.

2.05 NOISE CONTROL SLAB ISOLATION MAT

- A. Random-filament, corrugated, "U"-groove core sound control mat designed to limit impact noise between floors. Class A fire rated product.
- B. Accepted Manufacturers:
 - 1. Keene Quiet Qurl 55/025 MC MT.
 - 2. Hacker Sound Mat II

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation of Blanket Insulation: shall be installed on the cold side of electrical outlets, ducts, pipes, etc. Widths of insulation shall be butted snugly. Cut insulation and pack tightly to fill all angles, corners or irregular spaces.
- B. Install insulation shields or baffles stapled between adjacent top chords of trusses at each soffit vent location to assure air flow past blown-in insulation.
- C. Fit Insulation snugly between studs to get full friction fit. Pack around and behind outlet boxes, conduit, or piping to attain a complete barrier. Where batt insulation cannot effectively be placed to complete acoustic seal, use expanding foam insulation.
- D. Delivery and storage on-site of insulation products to strictly follow manufacturer's instructions
- E. Installation of insulation products to strictly follow manufacturer's instructions.

END OF SECTION

**SECTION 07900
JOINT SEALANTS**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Joint backup materials.
 - 2. Sealants.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 790 - Use of Latex Sealing Compounds.
 - 2. C 804 - Use of Solvent-Release Type Sealants.
 - 3. C 834 - Latex Sealing Compounds.
 - 4. C 920 - Elastomeric Joint Sealants.
 - 5. D 1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

1.03 SUBMITTALS

- A. Product Data: Sealants, primers, backup, bond breakers, and accessories proposed for use.
- B. Samples:
 - 1. Sealant samples showing available colors (if requested by Owner).
 - 2. 6 inch long joint backup material samples (if requested by Owner).

1.04 PROJECT CONDITIONS

- A. Do not apply sealants at temperatures below 40 degrees F unless approved by sealant manufacturer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Joint Sealant Type 1: (TREMCO 45 SSL)
 - 1. ASTM C 920, Type M, Grade P, Class 25, Uses T, M, A, and 0; multi-component polyurethane, self leveling.
 - 2. Movement capability: Plus or minus 25 percent.
 - 3. Color: To be selected from manufacturer's full color range.
- B. Joint Sealant Type 2: (TREMCO 45 SSL)
 - 1. ASTM C 920, Type M, Grade NS, Class 25, Uses T, M, A, and 0; multi-component polyurethane.

2. Shore A hardness: Between 45 and 50.
 3. Movement capability: Plus or minus 25 percent.
 4. Color: To be selected from manufacturer's full color range.
- C. Joint Sealant Type 3: (TREMCO 45 SSL)
1. ASTM C 920, Type S, Grade NS, Class 50, Uses NT, M, A, and 0; single-component polyurethane, non-sag.
 2. Movement capability: Plus or minus 50 percent.
 3. Color: To be selected from manufacturer's full color range.
- D. Joint Sealant Type 4:
1. ASTM C 834, single component acrylic latex, non-sag.
 2. Movement capability: Plus or minus 7-1/2 percent.
 3. Color: White.
- E. Joint Sealant Type 5:
1. ASTM C 920, Type S, Grade NS, Class 25, Uses NT, M, G and A; single component silicone, non-sag, mildew resistant.
 2. Movement capability: Plus or minus 25 percent.
 3. Color: To be selected from manufacturer's full color range.

2.02 ACCESSORIES

- A. Primers, Bond-breakers, and Solvents: As recommended by sealant manufacturer.
- B. Joint Backing:
1. ASTM D 1565, closed cell polyurethane foam, preformed round joint filler, non-absorbing, non-staining, resilient, and compatible with sealant and primer, recommended by sealant manufacturer for each sealant type.
 2. Size: Minimum 1.25 times joint width.

2.03 MIXES

- A. Mix in accordance with manufacturer's instructions.
- B. Mix multiple component sealants by mechanical mixer; avoid air entrainment and overheating occurring during mixing.
- C. Continue mixing until color is completely uniform, without streaks.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealant manufacturer for recommendation.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Protect adjacent surfaces from damage.

D. Sealant Dimensions:

1. Minimum joint size: 1/4 x 1/4 inch.
2. Joints 1/4 to 1/2 inch wide: Depth equal to width.
3. Joints over 1/2 inch wide: Depth equal to 1/2 width.

3.02 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Perform installation in accordance with ASTM C 804 for solvent release and ASTM C 790 for latex base sealants.
- C. Install joint backing to maintain required sealant dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.
- D. Use bond breaker tape where joint backing is not installed.
- E. Fill joints full without air pockets, embedded materials, ridges, and sags.
- F. Tool sealant to smooth profile.
- G. Apply sealant within recommended temperature range. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.03 CLEANING

- A. Remove masking tape and protective coatings after sealant has cured.
- B. Clean adjacent soiled surfaces.

3.04 SEALANT SCHEDULE

JOINT LOCATION OR TYPE	SEALANT TYPE
Exterior Joints:	
Horizontal joints subject to pedestrian or vehicular traffic:	
Slopes less than 1/4 inch per foot	1
Slopes of 1/4 inch per foot or more	2
Other joints	3
Interior Joints:	
Other Joints	4

END OF SECTION

**SECTION 08100
STEEL DOORS AND FRAMES**

PART 1 – GENERAL

1.01 SUMMARY

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

1.02 QUALITY ASSURANCE

- A. Comply with standards of the Steel Door Institute's "Recommended Specifications for Standard Steel Doors and Frames" S.D.I. 100.

1.03 JOB CONDITION

- A. Storage of the doors and frames shall be in a dry and protected area.
- B. Store doors in a vertical position; do not lay down flat.

1.04 RELATED WORK

- A. Specified Elsewhere:
 - 1. Door Hardware – See Section 08710

1.05 SUBMITTALS

- A. Complete submittals of all doors and related hardware for each door are to be provided in either an electronic format such as a ".pdf" file or in hard copy form.
- B. It will follow the door numbers as indicated on the Door Schedule in the Construction Documents.
- C. Each and every door will have its related door and hardware described.

PART 2 – PRODUCTS

2.01 METAL DOORS

- A. Rated Doors
 - 1. Pre-Hung HD Steel doors
- B. Provide stile and rail doors with seamless faces and edges, 1 3/4" thick 20 gage hollow steel construction, internally reinforced and insulated.
- C. Glazing – low E coated clear insulating glass.
- D. Finish – Prime painted to receive field applied top coat.

2.02 FRAMES

- A. Rated Frames
 - 1. Provide Welded Metal Frames when rated frames are required as indicated on the drawings with 14 gage hinge reinforcement in sizes to accommodate sidelights and transoms as shown on plans.
- B. Provide necessary clips and anchors suitable for wall conditions.
- C. Handicap Threshold as indicated on the drawings.
- D. Hardware Preparations
- E. Finish: Prime painted to receive field applied top coat.

2.03 FINISH HARDWARE

- A. Secure templates from hardware supplier.
- B. Adequately reinforce door construction and make provision for all finish hardware.
- C. Provide hardware as specified on the documents.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install per the drawings, SDI Specifications, manufacturer's recommendations and reviewed shop drawings.
 - 1. Frames shall be set level and plumb.
 - 2. Anchor frame to double stud jamb securely.

3.02 ADJUSTING AND PROTECTION

- A. Adjust, re-hang or replace doors which do not swing or operate freely.
- B. Protect doors as recommended by door manufacturer to ensure that doors will be without damage or deterioration at time of Substantial Completion.
- C. Replace doors damaged during installation.

END OF SECTION

Steel Doors and Frames

08100 - 3

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Steel Doors and Frames

08100 - 4

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**SECTION 08710
DOOR HARDWARE**

PART 1 – GENERAL

1.01 SUMMARY

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

1.02 SCOPE OF WORK

- A. Provide installation and adjustment of all finish hardware per drawings, this specification and approved shop drawings.

1.03 DELIVERY

- A. No hardware shall be ordered or delivered until after approval of door hardware submittal.
- B. Furnish and deliver finish hardware to the jobsite or to the door manufacturer as required, by prepaid shipments. Template information and complete schedules shall be furnished by hardware supplier, to manufacturers for use in preparing doors and frames.

1.04 DESCRIPTION

- A. Include items obviously required to complete this part of the contract. Items not specifically mentioned, but necessary to complete the work shall be furnished matching in quality and finish the items described or specified. See drawings and other specifications sections for further requirements.
- B. Modifications in hardware required for reason of construction details shall be made to provide specified function and operation UPON APPROVAL ONLY. Include necessary fastenings and including expansion shields, where permitted.

1.05 SUBMITTALS

- A. Complete submittals of all doors and related hardware for each door are to be provided in either an electronic format such as a “.pdf” file or in hard copy form. It will follow the door numbers as indicated on the Door Schedule in the Construction Documents. Each and every door will have its related door and hardware described.

PART 2 – PRODUCTS

2.01 HARDWARE SCHEDULE

- A. Supply all hardware for doors/openings by the following description & location as described in the door hardware schedule noted in the construction documents.
1. All finishes being as indicated in the Door Hardware Schedule.
 2. All handles for locks/passage sets to be as indicated on the Door Hardware Schedule.
 3. All hinges are to be supplied by door supplier, unless otherwise noted herein
 4. Hardware supplier to provide three, round, felt silencers for each wood door.

END OF SECTION

**SECTION 09260
GYPSUM BOARD**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Gypsum board.
 - 2. Gypsum sheathing.
 - 3. Taping and bedding of gypsum board.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 36 - Gypsum Wallboard.
 - 2. C 79 - Gypsum Sheathing Board.
 - 3. C 475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 4. C 514 - Nails for the Application of Gypsum Wallboard.
 - 5. C 630 - Water Resistant Gypsum Backing Board.
 - 6. C 931/931 M - Exterior Gypsum Soffit Board.
 - 7. C 1002 - Steel Drill Screws for the Application of Gypsum Board.
 - 8. ASTM C1178/C1178M Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
- B. Gypsum Association (GA):
 - 1. GA-214 - Levels of Gypsum Board Finish.
 - 2. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

1.03 PROJECT CONDITIONS

- A. Maintain temperature in spaces in which work is being performed above 50 degrees F during and after installation.
- B. Provide ventilation to facilitate drying.

PART 2 – PRODUCTS

2.01 PANEL PRODUCTS

- A. Regular Gypsum Board (manufactured products only from the USA): ASTM C 36; 48 inches wide, 5/8 inch thickness, maximum practical length, tapered edge.
- B. Fire Resistant Gypsum Board (manufactured products only from the USA): ASTM C 36, Type X; 48 inches wide, 5/8 inch thickness, maximum practical length, tapered edge; apply to fire rated assemblies. (The use of Dens-Glass Gold Type X is an acceptable alternate in this application.)

- C. Water Resistant Gypsum Board (manufactured products only from the USA): ASTM C 630; 48 inches wide, 5/8 inch thickness indicated, maximum practical length, water resistant
- D. Fire Resistant, Water Resistant Gypsum Board (manufactured products only from the USA): ASTM C 630, Type X; 48 inches wide, 5/8 inch thickness, maximum practical length, water resistant; apply to fire rated walls to receive ceramic tile. (The use of Dens-Glass Gold Type X is an acceptable alternate in this application.)
- E. DenShield® Fireguard® Type X Tile Backer (manufactured products only from the USA): ASTM C 1178; 48 inches wide, 5/8 inch thickness, square edge, maximum practical length, water resistant, fire rated; apply where shown on plans.

2.02 ACCESSORIES

- A. Fasteners: ASTM C 1002, Type W screws, minimum 5/8 inch penetration into framing.
- B. Metal Accessories: Galvanized steel unless otherwise indicated.
 - 1. Corner reinforcement: GA-216, Type CB-100 x 100
 - 2. Casing: GA-216, Type LC.
- C. Joint Treatment Materials: Reinforcing tape and joint compound; ASTM C 475.

PART 3 – EXECUTION

3.01 INSTALLATION OF GYPSUM PANELS

- A. Install panels and accessories in accordance with ASTM C 754, GA-216, and manufacturer's instructions.
- B. Accurately cut panels to fit around openings and projections. Do not tear face paper or break gypsum core.
- C. Place fasteners 12"o.c. in the field of the board and 7"o.c. along the entire perimeter of the sheet and a minimum 3/8 inch from edges of panels; drive heads slightly below surface. Stagger fasteners at abutting edges.
- D. Wall Panels:
 - 1. Apply non fire-rated gypsum panels in most economical manner, with ends and edges occurring over supports.
 - 2. Erect fire-rated gypsum panels as required by design assembly.
 - 3. Stagger joints on opposite sides of partitions.
 - 4. Do not locate joints to align with edges of openings unless a control joint is installed.
 - 5. Mechanically fasten panels to framing.
 - 6. Treat cut edges and holes in moisture resistant gypsum board with sealant.
 - 7. Where recessed items occur in fire rated partitions, box item on all sides with gypsum board as required to maintain continuity of fire rating.
- E. Install Water Resistant Gyp Board at all wet areas.

- F. Ceiling:
 - 1. Apply panel's perpendicular to framing, with end joints staggered.
 - 2. Support panels around openings in ceiling.
 - 3. Mechanically fasten to framing.

3.02 INSTALLATION OF ACCESSORIES

- A. Install in accordance with manufacturer's instructions.

3.03 JOINT TREATMENT

- A. Treat joints and fasteners in gypsum board In accordance with GA-214.
- B. Levels of Finish:
 - 1. Water resistant gypsum board: Level 2 finish.
 - 2. Surfaces to receive paints and wall coverings: Level 4 finish.

END OF SECTION

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**SECTION 09300
TILE FLOOR**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Ceramic tile floor.
- B. Related Sections:
 - 1. Division 1: Administrative, procedural, and temporary requirements.
 - 2. Section 07900 - Joint Sealants.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. AI 08.4 - Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
 - 2. AI 08.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
 - 3. A108.10 - Installation of Grout in Tile work.
 - 4. All 18.4 - Latex-Portland Cement Mortar.
 - 5. A-118.3 - Ceramic Tile Epoxy Grouts.
 - 6. AI 36.1 - Organic Adhesives for Installation of Ceramic Tile.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's installation, cleaning, and maintenance instructions.
- B. Samples:
 - 1. Tile: Full size tiles in selected colors.
 - 2. Grout: Epoxy Grout Cured samples showing available colors.
 - 3. Transition Strip: Schluter edging strip as indicated on drawings for the proper application.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver mortar, adhesive, and grout containers bearing hallmark certifying compliance with reference standards.
- B. Protect adhesive containers from freezing and overheating according to manufacturer's instructions.

1.05 PROJECT CONDITIONS

- A. Maintain minimum ambient temperature of 50 degrees F during and after installation.

1.06 MAINTENANCE

- A. Extra Stock:
 - 1. Provide 2 percent of each tile.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Ceramic or Porcelain Tile:
 - 1. Type as indicated on the drawings.

2.02 ACCESSORIES

- A. Latex-Portland Cement Mortar: ANSI A118.4, polymer modified dry set type.
- B. Organic Adhesive: ANSI A118.1, Type 1, thin set bond type.
- C. Water: Clean, potable.
- D. Grout:
 - 1. ANSI A118.3, Chemical resistant, water cleanable epoxy grout.
 - 2. Color: As indicated on the Drawings.
 - 3. Joints shall be no larger than 1/8" in width.
- E. Joint Sealant: Specified in Section 07900.
- F. Waterproofing at Ceramic Tile:
 - 1. Waterproofing where required for all wet area's including showers, Toilets, Janitorial, kitchen etc..., or as indicated in the documents shall be UltraCure 971 (elastomeric waterproofing and anti-fracture membrane) thin set mortar by C-Cure or approved equal.
- G. Transition Strip: Schluter transition strip as indicated on drawings for the proper application.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Clean surfaces to remove loose and foreign matter that could impair adhesion.
- B. Remove ridges and projections. Fill voids and depressions with patching compound compatible with setting materials.
- C. Allowable Substrate Tolerances:
 - 1. Maximum variation in substrate surface: 1/8 inch in 8 feet.
 - 2. Maximum height of abrupt irregularities: 1/32 inch.

3.02 INSTALLATION

- A. Methods:
 - 1. Walls: ANSI A108.4, thin set with organic adhesive.
 - 2. Floors: ANSI A108.5, thin set with latex-portland cement mortar.
- B. Minimize pieces less than one half size. Locate cuts to be inconspicuous.
- C. Place tile joints uniform in width. Align joints in wall and floor of same-sized tile.
- D. Fit tile around projections and at perimeter. Smooth and clean cut edges. Ensure that trim will completely cover cut edges.
- E. Install trim:
 - 1. Inside corners: Cove units.
 - 2. Outside comers: Bead units.
 - 3. Base: Base units.
 - 4. Exposed tile ends: Bullnose units.
- F. Sound tile after setting and before grouting. Replace hollow sounding units.
- G. Allow tile to set for a minimum of 48 hours before grouting.
- H. Grout tile joints in accordance with ANSI AI 08.10 without excess grout.
- I. Install sealant at changes in plane as specified in Section 07900.
- J. The Tile pattern shall be as indicated on the drawings.
- K. Use the appropriate Schluter transition strip as indicated.

3.03 ADJUSTING

- A. Remove and replace pieces that have been damaged during installation.

3.04 PROTECTION

- A. Provide protection for completed work using non-staining sheet coverings.
- B. Prohibit traffic on tile floors for minimum 3 days after installation.

END OF SECTION

Tile Floor
09300 - 4
01/26/2018

**SECTION 09650
VINYL FLOORING**

PART 1 – GENERAL

1.01 SUMMARY

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

1.02 WARRANTY

- A. See Division 1. Defects in material and workmanship subject to correction under the terms of the guarantee shall include among others, loosening of tile and bleeding of joints.

1.03 QUALITY ASSURANCE

- A. Standards and Specifications: Comply with applicable standards and specifications of the following organizations, except as specified otherwise in this section:
 - 1. ASTM F1303; Type I, Grade 2
- B. Matching Appearance: Each product shall be from single or compatible matching factory runs so to minimize the variations in quality, except that each space and room shall be from a single factory run. Shipping cartons shall be marked to identify matching runs. Non-matching and variations in appearance or quality of the products shall be rejected.

PART 2 – PRODUCTS

2.01 TYPE

- A. Type as indicated on the Construction Documents.

2.02 ACCESSORIES

- A. Transition Strip: Roppe edging transition strip as indicated on the drawings for this application and what it is transitioning to.

2.03 ADHESIVE

- A. Per tile manufacture recommendations.

PART 3 – EXECUTION

3.01 JOB CONDITIONS

- A. Maintain temperature at least 70 degrees Fahrenheit in tile storage spaces. In room where vinyl is to be laid, maintain temperature of at least 70 degrees F. for 48 hours before and after vinyl is laid.
- B. Examine substrates for moisture content and other conditions under which vinyl is to be installed. Repair minor holes, cracks, depressions or rough areas using material recommended by vinyl and adhesive manufacturer. Notify Contractor in writing of major conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- C. Clear away debris and scrape up cementitious deposits from surfaces to receive vinyl; vacuum clean immediately before installation. Check concrete surfaces to ensure that no "dusting" will occur below vinyl installation; apply sealer where required to prevent dusting.
- D. Sequence vinyl work with other work so as to minimize possibility of damage and soiling of vinyl during remainder of construction period.

3.02 INSTALLATION

- A. Congoleum resilient sheet products are designed to be installed in enclosed areas where temperatures will not fall below 55°F or go above 100°F.
- B. The subfloor, flooring material, and adhesive should be conditioned at a constant temperature between 65°F and 85°F for 48 hours prior to, during, and for 48 hours after installation. Thereafter, maintain room temperature between 55°F and 100°F.
- C. Install sheets in the order they are taken from the roll. Install rolls, if using more than one, in consecutive roll number order.
- D. It takes about 48 hours for the adhesive to dry. Keep traffic clear from floor until adhesive is sufficiently dry.
- E. All free or open edges shall have continuous Roppe Transition strip as indicated on the drawings.

3.03 EXTRA

- A. Usable scraps of sheet vinyl, deemed as pieces of more than 10 sq. ft. in area, shall be saved and left on the premises for the Owner's use.

END OF SECTION

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**SECTION 09687
CARPET**

PART 1 – GENERAL

1.01 SUMMARY

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division I of these Specifications.

1.02 QUALITY ASSURANCE

- A. Installer shall not have less with not less than 5 years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section.

1.03 PRODUCT DELIVERY AND STORAGE

- A. Deliver carpeting materials in original mill protective wrapping with mill register numbers and tags attached. Store inside, in well ventilated area protected from weather, moisture and soiling.

1.04 WARRANTY

- A. Provide special warranty, signed by Installer and Manufacturer (carpet mill), agreeing to repair or replace defective materials and workmanship of carpeting work during one-year warranty period following substantial completion. Attach copies of product warranties.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Carpet material as specified in drawings.

2.02 ACCESSORIES

- A. Other products necessary to complete installation and/or as noted on Drawings and Details.
- B. Transition Strip: Schluter or Roppe edging transition strip as indicated on the drawings for this application and what it is transitioning to.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Examine substrates for moisture content and other conditions under which carpeting is to be installed. Repair minor holes, cracks, depressions or rough areas using material recommended by carpet or adhesive manufacturer. Notify Contractor in writing of major conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Clear away debris and scrape up cementitious deposits from surfaces to receive carpeting; vacuum clean immediately before installation. Check concrete surfaces to ensure no "dusting" through installed carpet; apply sealer where required to prevent dusting.
- C. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.02 INSTALLATION

- A. Comply with Owner's instructions and drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doors, center seams under doors; do not place seams in traffic direction at doorways.
- B. Use a Premium carpet adhesive that is solvent free Taylor 2072 or equivalent as recommended by the carpet manufacturer.
- C. Provide cut-outs where required and bind Cut edges properly where not concealed by protective edge guards or overlapping flanges.
- D. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.
- E. Install carpet by trimming edges, buttering cuts with seaming cement, taping or sewing or taping- and-sewing seams to provide sufficient strength for stretching and continued stresses during life of carpet. Apply seaming cement over stitching on backing, if not covered by tape.

3.03 CLEANING AND PROTECTION

- A. Vacuum carpet using commercial machine with face-beater element. Remove spots and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors.
- A. Advise Contractor of protection methods and materials needed to ensure that carpeting will be without deterioration or damage at time of substantial completion.

END OF SECTION

Carpet
09687 - 3
01/26/2018

Carpet
09687 - 4
01/26/2018

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**SECTION 09900
PAINTING**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Texturing of gypsum board.
 - 2. Surface preparation and field application of paints.

1.02 SUBMITTALS

- A. Product Data: Manufacturer's data on materials proposed for use. Include:
 - 1. Product designation and grade of each paint type.
 - 2. Surface preparation materials and procedures.
 - 3. Product analysis and performance characteristics for each paint type.
- B. Samples:
 - 1. 3 x 6 inch samples of each type paint showing color and luster, on representative substrate. Apply each coat stepped back 1 inch so that all coats remain exposed. Indicate type of material used for each coat.
 - 2. 24 x 24 inch texture samples on gypsum board backing.
- C. Paint Schedule: Detailed schedule indicating type and location of surface, paint materials, and number of coats to be applied.

1.03 PRODUCT DELIVERY AND STORAGE

- A. Deliver paints factory mixed.
- B. Keep storage area clean; protect from paint spillage.

1.04 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Apply paints under dry and dust free conditions.
 - 2. Ambient temperature: Between 50° and 90°F.
 - 3. Humidity: Maximum 50 percent.
 - 4. Perform work under adequate lighting conditions.

1.05 MAINTENANCE

- A. Extra Stock:
 - 1. Provide one unopened 1-gallon containers of each color and type finish coat.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Contract Documents are based on products by Sherwin Williams.
- B. No Exceptions will be taken.

2.02 MATERIALS

- A. Paints:
 - 1. Furnish all paints by same manufacturer.
 - 2. See Sheet A4.00 of the Contract Documents for paint products required for each surface.

2.03 ACCESSORIES

- A. Gypsum Board Texture: Medium Knock Down Finish.
- B. Ceiling Texture: Heavy Knock Down Finish.
- C. Surface Preparation Materials: Formulated for particular application.
- D. Thinners and Cleaners: As recommended by paint manufacturer.

2.04 MIXING

- A. Colors: Refer to Contract Documents for color & finish schedule.
- B. Use factory mixed paints matching approved color samples.
- C. Uniformly mix paints to thoroughly disperse pigments prior to applying.
- D. Do not thin paint in excess of manufacturer's recommendations.

PART 3 – EXECUTION

3.01 PREPARATION

- A. General:
 - 1. Protect or remove items subject to damage or discoloration from painting.
 - 2. Protect surfaces not requiring painting.
 - 3. Clean and dry surface before painting. Remove dirt and dust by brushing with stiff bristle brush. Remove oil or grease by solvent cleaning.
 - 4. If area has been subject to chemical contamination, thoroughly rinse with water.
 - 5. Apply primer or first coat immediately after surface preparation to prevent contamination of surface.
- B. Cement Composition Siding/Panels:
 - 1. Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow drying.
 - 2. Existing peeled or checked paint should be scraped and sanded to a sound surface.

3. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material and peeling or defective coatings.
 4. Allow the surface to dry thoroughly.
 5. The pH of the surface should be between 6 and 9, unless the products to be used are designed to be used in the high pH environments such as Loxon.
- C. Drywall:
1. Must be clean and dry.
 2. All screw heads must be set and spackled.
 3. Joints need to be taped and covered with a joint compound.
 4. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.
 5. Interior Walls: Apply medium knock down texture finish in accordance manufacturer's instructions. GC to get sample of the proposed finish to be used approved before application of the product begins. Once approval is received then the GC must apply this product on only one wall in one unit and get approval from the UNLV representative before proceeding.
- D. Galvanized Metal:
1. Allow to weather a minimum of 6 months prior to coating.
 2. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner, then prime as required.
 3. When weathering is not possible or the surface has been treated chromate's or silicates, first Solvent Clean per SSPC-SP1 and apply a test area, priming as required.
 4. Allow the coating to dry at least one week before testing.
 5. If adhesion is poor, Brush Blast per SSPC-SP7 as necessary to remove these treatments.
- E. Hand Tool Cleaning:
1. Hand Tool Cleaning removes all loose mill scale, loose rust and other foreign matter.
 2. It is not intended that adherent mill scale, rust and paint be removed by this process.
 3. Mill Scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.
 4. Before hand tool cleaning remove visible oil, grease, soluble residues and salts by the method outlined in SSPC-SP1.
 5. For complete instructions, refer to Steel Structures Paint Council Preparation Specification No.3 (SSP-PC3).
- F. Power Tool Cleaning:
1. Power Tool Cleaning removes all loose mill scale, rust and other detrimental foreign matter. It is not intended that adherent mill scale, rust and paint be removed by this process.
 2. Mill scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

3. Before Power tool cleaning remove visible oil, grease, soluble residues and salts by the methods outlined in SSPC-SP1.
 4. For complete instructions, refer to Steel Structures Paint Council Preparation Specification No.3 (SSP-PC3).
- G. Wood (Exterior):
1. Must be clean and dry.
 2. Prime and paint as soon as possible.
 3. Knots and pitch streaks must be scraped, sanded and spot primed before a full priming coating is applied.
 4. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.
- H. Wood (Interior):
1. All finishing lumber and flooring must be stored in dry, warm rooms to prevent absorption of moisture, shrinkage and roughening of the wood.
 2. All surfaces must be sanded smooth with the grain and never across it.
 3. Surface blemishes must be corrected and the area cleaned of dust before coating.
- I. Block (Cinder and Concrete):
1. Remove all loose mortar and foreign material.
 2. Surface must be free of laitance, concrete dust, dirt, and form release agents, moisture curing membranes, loose cement and hardeners.
 3. Concrete and mortar must be cured at least 28 days at 75°F.
 4. The pH of the surface should be between 6 and 9.
 5. On tilt-up and poured in place concrete commercial detergents and abrasive blasting may be necessary to prepare the surface.
 6. Fill bug holes, air pockets and other voids with a cement patching compound (per ASTM D4261).
 7. Apply block filler and paint as soon as possible.

3.02 APPLICATION

- A. Apply paint to minimum dry film thickness recommended by manufacturer.
- B. Apply paint uniformly without laps, sags, curtains, holidays, and objectionable brush marks.
- C. Apply paint uniformly without laps, sags, curtains, holidays, and objectionable brush marks.
- D. Ensure that each coat is undamaged prior to applying succeeding coat.
- E. Sand between coats on interior wood surfaces prior to application of succeeding coats.
- F. Match final coat of paint to approved color samples.
- G. Mechanical and Electrical Items:
 1. Paint factory primed equipment.
 2. Remove unfinished and primed louvers, grilles, covers, and access panels; paint separately.
 3. Paint exposed pipes, conduit, boxes, brackets, collars, and supports unless factory finished.

4. Do not paint name tags or identifying markings.
- H. Do not paint:
 1. Surfaces indicated on Drawings or specified to be unpainted or unfinished.
 2. Surfaces with factory applied finish coat or integral finish.
 3. Architectural metals, including brass, bronze, stainless steel, and chrome plating.

3.03 FIELD QUALITY CONTROL

- A. Manufacturers Field Services: Ensure that materials are being applied properly.

3.04 ADJUSTING

- A. Make detailed inspection of paint work; touch up abraded, stained, and otherwise disfigured surfaces or refinish as required. If touch up area is visible repaint entire wall.

3.05 CLEANING

- A. Remove paint from adjacent surfaces.

3.06 PAINT SCHEDULE

- A. Types of paint listed herein are set forth as standard of quality and type of paint required for each type of surface.
 1. Exposed surfaces of type listed in following schedule are to be painted.
 2. Other exposed surfaces not specifically listed shall receive not less than two coats of appropriate type of paint.
- B. Prime coat shall consist of touch up only on shop primed and existing surfaces.
- C. Exterior Finishes:
 1. Doors
 - a. Primer: B66W00001 – DTM Acrylic Primer Finish White.
 - b. Coat 1: A08T00154 – Super Paint Exterior Acrylic Latex Semi-Gloss Ultra White (See Architectural Drawings for Color)
 - c. Coat 2: A08T00154 – Super Paint Exterior Acrylic Latex Semi-Gloss Ultra White (See Architectural Drawings for Color)
 2. Post and Stringers
 - a. Coat 1: A15W00051 – WoodScapes Exterior Acrylic Solid Color Stain Extra White (See Architectural Drawings for Color)
 - b. Coat 2: A15W00051 – WoodScapes Exterior Acrylic Solid Color Stain Extra White (See Architectural Drawings for Color)
 - c. Wait 24 hours if tannins come through first coat.

3. Misc Trim
 - a. Primer: B66W00001 – DTM Acrylic Primer Finish White.
 - b. Coat 1: A08T00154 – Super Paint Exterior Acrylic Latex Semi-Gloss Ultra White (See Architectural Drawings for Color)
 - c. Coat 2: A08T00154 – Super Paint Exterior Acrylic Latex Semi-Gloss Ultra White (See Architectural Drawings for Color)
- D. Interior Surfaces:
 1. Wood Trim (Painted)
 - a. Primer: B28W00101 – PrepRite Classic Interior Latex Primer White.
 - b. Coat 1: B31W04451 – ProClassic Interior Acrylic Latex Semi-Gloss Extra White. (See Architectural Drawings for Color)
 - c. Coat 2: B31W04451 – ProClassic Interior Acrylic Latex Semi-Gloss Extra White. (See Architectural Drawings for Color)
 2. Drywall (Walls)
 - a. Primer: B28W00601 – High Build Interior Latex Primer White before or after texture if textured.
 - b. Coat 1: B20W04451 – ProMar 200 Interior Latex Eg-Shel or Semi-Gloss Extra White. (See Architectural Drawings for Color and Sheen)
 - c. Coat 1: B20W04451 – ProMar 200 Interior Latex Eg-Shel or Semi-Gloss Extra White. (See Architectural Drawings for Color and Sheen)
 3. Drywall (Ceiling)
 - a. Primer: B28W00601 – High Build Interior Latex Primer White.
 - b. Coat 1: Builders Solution Interior Latex Matte Extra White. (See Architectural Drawings for Color)
 - c. Coat 2: Builders Solution Interior Latex Matte Extra White. (See Architectural Drawings for Color)
 4. Concrete Block
 - a. Primer: B25W00025 – PrepRite Block Filler White
 - b. Coat 1: B20W04451 – ProMar 200 Interior Latex Eg-Shel Extra White. (See Architectural Drawings for Color)
 - c. Coat 2: B20W04451 – ProMar 200 Interior Latex Eg-Shel Extra White. (See Architectural Drawings for Color)

END OF SECTION

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SECTION: 10260
BULLET RESISTANT PANELS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes bullet resistant fiberglass panels.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM E119-98 Standard Test for One-Hour Fire-Rating of Building Construction and Materials
 - 2. ASTM F1233-98 Standard Test Method for Forced Entry Testing of Materials/Assemblies, body passage requirement, Class IV
 - 3. ASTM E 90-97 Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, STC 35
 - 4. ASTM E 413-87 Classification for Sound Insulation Rating
 - 5. ASTM E 1332-90 Classification for Determination of Outdoor-Indoor Transmission Class, OITC 34
- B. International Organization for Standardization:
 - 1. ISO 9001:2008 Quality Management System
- C. Small Business Administration:
 - 1. SBA Small Business Size Standard
- D. Underwriters Laboratories:
 - 1. UL 752 Specifications and Ammunition, 11th Edition, Standard for Bullet Resisting Equipment published September 9, 2005, revised December 21, 2006, Level 4
- E. The United States Department of State:
 - 1. The International Traffic in Arms Regulations (ITAR)

1.3 SUBMITTALS

- A. Submittals for Review: Submit for approval prior to fabrication.
 - 1. Product Data: Include specifications, brochures, and samples.
 - 2. Recommendations for installation of Bullet Resistant Fiberglass Panels available in [print document](#) and [video link](#).
- B. Certificates: Submit printed data to indicate compliance with following requirements.
 - 1. **UL LISTING Verification** and **UL752 Current Test Results** as provided by Underwriters Laboratories.
 - 2. ASTM E119-98 One-Hour Fire Rating of Building Construction and Materials.

3. ASTM F1233-98 Standard Test Method for Forced Entry Testing of Materials/Assemblies.
4. ASTM E 90-97, E 413-87, E 13320-90 Classifications for Sound Transmission Loss.
5. Manufacturer's third party certificate of registration with ISO 9001:2008.
6. Manufacturer's U.S. Dept. of State ITAR Statement of Registration.
7. Manufacturer's SBA Profile verifying small business status by the SBA.

1.4 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials to project with manufacturer's **UL LISTED Labels** intact and legible.
- B. Handle material with care to prevent damage. Store materials inside under cover, stack flat and off the floor.

1.5 WARRANTY

- A. Warrant all materials and workmanship against defects for a period of ten (10) years from the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. Design Basis: Contract Documents are based on ArmorCore by **Waco Composites**, (Waco, TX 76710, phone: 254-752-3622, toll free: 866-688-3088, email: sales@armorcore.com, web: www.armorcore.com) or equal.

2.2 PERFORMANCE CRITERIA

- A. Bullet Resistant Fiberglass Panels shall be “non ricochet type” to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.
- B. Panel Rating: UL752 Level 4.
- C. Bullet resistance of joints: equal to that of the panel.

2.3 MATERIALS

- A. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.
- B. Thickness: 1 3/8” nominal thickness
- C. Nominal Weight: 13.9 lbs. per sq. ft.
- D. Available Panel Sizes: [3' x 8'] [3' x 9'] [3' x 10'] [4' x 8'] [4' x 9'] [4' x 10'] [5' x 8'] [5' x 9'] [5' x 10'] [Custom]
- E. Panels manufactured in the United States of America with raw materials sourced from the U.S.A. for quality assurance purposes and to comply with any applicable “Buy American” provisions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to starting installation, verify work of related trades required in contract documents and architectural drawings is complete to the point where work of this Section may properly commence.

3.2 JOINTS

- A. Reinforce joints with a back-up layer of bullet resistive material. Minimum width of reinforcing layer at joint shall be 4-inches, centered on panel joints.

3.3 APPLICATION

- A. Install armor in accordance with manufacturer's [printed recommendations](#) and as required by contract documents.
- B. Secure armor panels using screws, bolts, or an industrial adhesive.
 - 1. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and the like.

END OF SECTION

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**SECTION 10800
TOILET ROOM ACCESSORIES**

PART 1 – GENERAL

1.01 SUMMARY

- A. Provide toilet room accessories where indicated on drawings.
- B. Related Work: Documents affecting work of this Section include Sections in Division 1 of these Specifications.

1.02 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.

PART 2 – PRODUCTS

2.01 TOILET ROOM ACCESSORIES

- A. Acceptable manufacturers: Provide all items from single manufacturer.
 - 1. Hillyard
 - 2. American Specialties Inc.
 - 3. Bobrick
 - 4. JBG Industries
- B. Provide Satin finish stainless steel on all items of this Section.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Coordinate with other trades to assure proper and adequate provisions have been made for the work of this Section.
- B. Install each item in its proper location. Firmly anchored, level and plumb and in full compliance of manufacturer's recommendations.

END OF SECTION

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**SECTION 11452
APPLIANCES**

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included This Section:

1. Supply and Install appliances as indicated on drawings. Appliances shall be delivered to the jobsite by the Owner Specified Supplier. The unloading, storage and installation of the appliances in accordance with all governing regulations will be by the General Contractor.

1.02 DEFINITIONS

A. Equipment Logistical Responsibility:

1. General Contractor Furnished — General Contractor Installed (CFCI)
 - a. The General Contractor shall be responsible for receiving, storing, protecting, providing all rough-in services, installing, and testing of equipment and systems.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Refer to the Construction Documents for the Appliance Schedule.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install appliances according to manufacturers written instructions.

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SECTION 15100
BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SCOPE

- A. Provide piping system and other equipment as specified to provide complete and operating systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Insulation | Section 15180 |
| C. Domestic Water | Section 15200 |
| D. Sanitary Waste | Section 15300 |
| E. Plumbing | Section 15400 |
| F. Refrigeration | Section 15650 |
| G. Air Distribution | Section 15800 |
| H. System Test and Balancing | Section 15850 |
| I. Temperature Controls | Section 15900 |
| J. Wiring Devices | Section 16140 |
| K. Motors and Circuit Disconnects | Section 16170 |
| L. Controls and Instrumentation | Section 16900 |

1.03 QUALITY ASSURANCE

- A. Installer: Installer shall have a minimum of five years experience in the installation of mechanical equipment and systems of similar size and scope.
- B. Design Criteria: Catalog numbers for the various manufacturers listed. Proposed substitution shall be approved in accordance with Section 01630
- C. Codes and Standards:
1. Local Building Code
 2. Local Mechanical Code
 3. Local Plumbing Code
 4. National Electrical Code
 5. ASME Codes
 6. ASTM Standards
 7. State Plumbing Code
 8. State Mechanical Code
 9. State Electrical Code
 - 10 All Authorities having Jurisdiction

1.04 SUBMITTALS

- A. Shop Drawings:

1. Submit in accordance with Section 01340. Indicate construction materials, finishes, sizes, quantities, and related hardware requirements. Re-submittals of rejected submittals shall be limited to two (2) in number. Third submittal for same item will be billed at \$50.00 per hour.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect materials in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall be rejected. Security for the material is the responsibility of the GC.

1.06 COORDINATION

- A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings required field's measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.
- B. Consult with other trades in advance and make provisions for their work to avoid cutting and patching.

PART 2 – PRODUCTS

2.01 PIPING

- A. Cooling coil condensate Drain Piping
 1. PVC Schedule 40
 2. Solvent welded connections.
- B. Domestic Water:
 1. Pipe: Type "K" hard copper underground, but not allowed under building concrete slab Type "K" hard copper above grade or above finish floor concrete slab. Below concrete Type "L" soft drawn copper. Inlet 2 1/2 inch potable water service to building shall be installed with Watts-Ames Fire & Water RZP back flow preventer for potable water service 2 1/2" min. size with options of S-bronze strainer, LH-locking handles, QT- quarter turn handles, and U-union connections. Internal shut off shall conform to ASSE 1015 and AWWA C510. No substitution or equal will be allowed. Pex Tubing will not be allowed under building slab, structural beams or footings or any structural concrete element of the building. No "Pex" usage for Cold water service to building water heaters or hot water service leaving water heaters until non exposed in wall or ceiling. Hot water return piping shall be type "K" copper when exposed into mechanical room. No "Pex Tubing will be allowed to be exposed in any Mechanical Room Cold water service leaving the backflow preventer shall be type "K" until it leaves mechanical room and is non exposed in ceiling or wall. Entire water heater manifold will be installed with type "K" copper. No fillings or joints allowed below building concrete slab.. sleeve all copper

piping with $\frac{3}{4}$ " closed cell insulation when installed under building slab with a minimum of six inches exposed on both ends. Sleeve all "PEX" tubing where it passes through gypcrete or floor underlayment. All sleeves shall be sealed properly as required by fire code or to prevent water, weather or insect penetration. Cover with $\frac{3}{4}$ " closed cell insulation where piping comes into contact with gypcrete, floor underlayment or use pre-sleeved Pex tubing as made by Uponor. No manifolds in units or mechanical rooms of Pex tubing will be allowed. All cross-linked polyethylene tubing shall be either "Pex-a or b". No "Pex-c" will be allowed. All tubing must have proper ASTM markings as follows, ASTM F 876 or F 876/877, Dimension ratio SDR 9 pressure rating 160psi@73.4, 100psi@180 degrees F NSF-pw, UPC, UL, IAPMO. Do not allow tubing to come in contact with fire sealing compounds except water soluble, gypsum-based caulking or other sealants approved by the Pex tube manufacture. Examples are Hercules Chemical Plumber's Firestop Sealant or Rectorseal Metacaulk 1000 Firestopping Sealant. An alternate to firestopping compound is Rectorseal Metacaulk Pipe Collar. Only colors "RED" and "BLUE" "Pex" tubing will be allowed as run out to the plumbing fixtures from the main water header on each floor. White "Pex" tubing shall be allowed as the water supply header in the building above the structural finished slab elevation for the building. No bushings will be allowed of any type in domestic water piping. All return hot water piping to water heaters shall be red in color. The following manufactures are approved for use, GTGLOBE(GTPEX), Watts, Vanguard (Pex Ultra) Uponor and Nibco. The following fittings are approved for installation with Pex tubing. Metal fittings, similar to the following, Rifeng Crimp Fittings in brass or copper or Vega Pex Press fittings w/sleeve, with copper crimp rings, stainless steel clamp, and stainless steel sleeve. No plastic fittings or rings will be allowed. PushType Fittings, Plastic or metal, PVC, Cpvc Plastic Ferrule Fittings Plastic fitting clamp ring or ProPex cold expansion type expander fittings will not be allowed. Keep all "PEX" tubing a minimum of 12 inches vertically or 6 inches horizontally from light fixtures. If "Pex" is not allowed by Code all water piping in building shall be Type "K" copper. Copper or "Pex" tubing piping used for domestic hot water and hot water return piping shall be insulated with $\frac{3}{4}$ " closed foam insulation with all factory formed corners. All joints will be glued. No tape for cuts or joints will be allowed. This shall apply to hot and hot water return within the entire building. Under no circumstances shall PVC or CPVC be allowed in non fire service for water on the project. Under no circumstances shall "Pex" tubing be allowed under any concrete slab or structural element for the entire project. HDPE tubing is acceptable for domestic water service to building with no connections under concrete slab. It shall not be allowed after the RZP.

2. All Pex tubing penetrating thru vertical 2x wall studs shall use a Hold Rite Acoustic Isolator, 261, 263 or 263 in the approximate size. When traversing vertically with Pex tubing in a vertical wall next to a plumbing

riser use Hold Rite Clamp 104, a Hold Rite series 103 and 110R Hold Rite bracket. Stub outs between studs shall use a Hold Rite 103-18-701 galvanized bracket and tube clamp. Shower heads mount with Hold Rite bracket SB1 or SB2 and Acoustic Isolation Silencer 265.

3. Under no circumstances shall Pex tubing be allowed within 2" of a vertical or horizontal stud or any 2x material which will receive drywall material without a metal plate to protect it for the entire length of the tubing and drywall run or at ceiling or floor level.
 4. No Hub and Spigot cast iron pipe or fittings allowed under concrete slabs.
 5. No lead of any type on concentration allowed.
 6. No gasket S/S type of clamp fitting allowed for any pipe connections.
- C. Soil, Waste and Vent Piping:
1. Soil, waste and vent piping below grade shall be schedule 40 PVC and formed hubs (NUB'S) in each length of pipe. No slip couplings.
 2. Soil, waste and vent piping above grade shall be schedule 40 PVC with solvent weld joints and fittings.
 3. No DWV schedule 10 or PVC with less than a dual rating of ASTM D 1785 and ASTM D 2665. No Foam Core DWV will be allowed on the project. All PVC piping will be solid core.
- D. Gas Piping:
1. Exterior Below Grade: "NIPAK" polypropylene orange gas piping with ANSI joints and copper trace wire.
 2. Interior and Above Grade: schedule 40 black steel complying with ANSI B36.10 with matching screwed fittings. Enclose in vented sleeve where noted on plans.
- E. Refrigerant Piping: Type "L" hard drawn copper dehydrated refrigeration copper with matching refrigeration type wrought copper fittings with "Silfos" joints. Not allowed in concealed spaces or behind drywall installations
- F. Services other than named above Shall be allowed if required by AHJ or State plumbing
- G. code. Please supply code requirement in writing by AHJ.
- H. Fittings Material: Fittings for copper tubing shall be Mueller Brass Company's "Streamline" solder fittings. Schedule 10 drainage type fittings shall not be used or allowed anywhere. Solders for copper tubing, unless otherwise specified, shall be lead free and have a melting point of not less than 460 Deg. F., composed of 95% tin and 5% antimony. Piping shall be installed in a workmanlike manner, according to the manufacturer's instructions. Joints shall be cleaned before connecting. Cast iron fittings shall be Crane or Grinnell. Welding fittings shall be Tube-Turn, Midwest, Taylor Forge, and Ladish. Welding fittings shall have the same bursting pressure as pipe of the same size and schedule. Elbows in welded piping systems shall be long radius.
- I. Viega Pro-Press System or similar systems will not be allowed.
- J. PEX or Equal. Plumbing subcontractor to submit data on "equivalent" piping to Owner, Contractor, Architect, and Engineer for approval.

2.02 VALVES

- A. Furnish and install valves indicated on the plans or required to control the flow of water and gas to and from various parts of the system, in and out of various pieces of machinery and equipment, to segregate various parts of the individual systems.
- B. Generally, valves shall be of the type and pattern corresponding to the following listings, but where necessitated by particular conditions or classes of work, special valves shall be employed.
- C. Valves in copper lines 3" in size and smaller shall be ball valves. Valves shall be manufactured by Crane, Red-White, Stockham, Jenkins, and Lukenheimer. Valves in PVC 3" or smaller shall be ball valves.

<u>Valve Type</u>	<u>Valve Size</u>
Ball	3" and smaller
Gate	3-1/2" and larger

- D. Where valves have discs they shall be selected for the intended service using those materials recommended by the manufacturer.
- E. Where cocks are required, they shall generally be brass, screwed pattern up to 2" and cast iron flanged pattern 2-1/2" and larger plug cocks required such as pet cocks, gauge cocks, etc.
- F. Cocks in gas lines shall be Crane No. 250 2" and smaller. 2 1/2" and larger Nordstrom No. 142 2", use Nordstrom No. 143 with removable handle.
- G. **No check valve will be allowed in vertical service unless they are non-slamming as confirmed by manufacture specifications.**
- H. Where valves or cocks are installed in chrome-plated lines, they shall be chrome plated to match.
- I. Iron body gate valves listed shall be brass or bronze trimmed.
- J. Connections between screw joint valves listed shall be brass or bronze trimmed.
- K. Special types of valves shall be employed in any lines where specified elsewhere or required by conditions existing at the job site. Prior approval shall be obtained for such valves. Water heater isolation valves shall be Webstone Pro-Pal Series Ball Drain item #40613. Installation shall be within 12 inches of the inlet and outlet of the heater.
- L. Provide and install valves and valve boxes where shown on the drawings and as required.
- M. All valves shall be full line size unless otherwise noted.
- N. All valves and stopcocks shall be provided and installed where shown on the drawings and as necessary to make all systems complete.
- O. All branch lines shall have ball valves installed whether shown on the drawings or not.
- P. Valves shall be provided on inlet and outlet connections of all equipment
- Q. Valves shall be provided at inlet and/or outlet of all fixtures and apparatus.
- R. Valves shall be installed in all bypasses.
- S. Provide necessary drain valves at low points in systems to drain all piping systems.
- T. Valves and cocks exposed at fixtures shall be chrome plated.

- U. All valves shall be installed in accessible locations.
- V. Set tops of all valve boxes flush with finished grade.
- W. All manual hot water return balancing valves shall be the following
 - 1. Bronze ball valves
 - a. Nibco 1710 DZR Brass Circuit Balancing Valves
 - i.
- X. A balancing report shall be required for the entire hot water return system showing the water flow at each balancing valve and at the water heaters when the circulating pump is running. The time required for receiving hot water [no more than 3 degrees less than set temperature at heater] at any hot water discharge point in the building shall not exceed between 60 seconds.

2.03 UNIONS

- A. Provide and install union between each item of dissimilar metal on equipment and the valve controlling or the various piping connections to it. Unions shall be manufactured by Crane, Nibco, Mueller, Grinnell, or Walworth, and shall be as followed:
 - 1. Steel Pipe: Unions 2" and smaller shall be malleable iron with brass seat and ground joints. Unions 2-1/2" and larger shall flanged unions.
 - 2. Copper Pipe: Unions 2" and smaller, brass ground joints shall be copper to copper. Unions 2-1/2" and large shall be brass flanged unions with brass bolts.
 - 3. PVC Pipe: Unions shall be schedule 40 PVC w/joints PVC to PVC.
 - 4. Unions shall not be concealed in walls, ceilings or partitions without an access door. No access panels will be permitted in living areas other than mechanical rooms.

2.04 ACCESS DOORS

- A. Provide and install doors as required for complete access motor operated and manual control dampers, fire dampers, adjusters, valves, coils, vents, and equipment requiring service installed by the contractor.
- B. Access doors in ducts shall have suitable frames, hinges; hold down devices required for complete and ready access. Where installed in insulated ducts, insulated doors with internal insulation shall be installed to prevent sweating. Submit shop drawings for approval before installation.
- C. Access doors required in chases, ceilings, furring, and walls of general construction shall be provided by the general contractor.

2.05 BELT GUARDS

- A. Furnish belt guards for all belt driven equipment, which is installed under this contract. Such belt guards shall be rigidly constructed of 18 gauge sheet metal on an iron frame, and shall have fronts of expanded metal or 1/2" mesh hardware cloth. They shall be such size as to permit belt tightening to the full

extent of the motor slide rails. They shall be securely installed in such fashion that they can be readily removed to permit servicing of the protected drive.

- B. Where factory assembled equipment is furnished by its manufacturer with belt guards, such guards shall be used in lieu of those specified herein.

2.06 GASKETS

- A. Gaskets shall be placed between the flanged of all flanged joints. Gaskets in water lines shall be 1/16" thick gaskets cut from Garlicky 24 Wire Insertion Red Rubber Sheet Packing. Gaskets shall be cut to fit within the bolt circle.

2.07 CONNECTIONS

- A. Make final Natural Gas or Propane connections to the water heaters, kitchen equipment, etc. Final connections to be of the same materials as supply lines.

PART 3 – EXECUTION

3.01 VALVE INSTALLATION

- A. Provide and install valves that are shown on the drawings, specified, or that may be necessary to install complete, controlled, and properly operating systems as required by code, and as approved by the Owner.
- B. Each hot and cold water branch line or riser serving each unit shall be separately valved where it is connected to its respective unit main.
- C. Valves shall be located in accessible positions or made accessible through removable panels and where several valves are related as to function, they shall be grouped in a battery. Valve handles shall not conflict with each other for hot or cold water service in order to close or open and shall be capable of opening or closing completely as indicated on the valve. Contractor shall arrange for proper location of access panels subject to approval of the Owner. Particular care shall be exercise to avoid leaving tool marks and scratches where connections are exposed in toilet rooms, machine rooms, and other conspicuous places.
- D. Provide and install shop valves of the indicated or required type in piping systems, at mains, at outlets of equipment, and other appurtenances; in by-passes, make-up water lines and fill, and at other places designated on the plans or required to control flow of water or to various sections of the building and to various groups or fixtures; items of equipment, etc., the supply of water every plumbing fixture specified to be installed under this contract or provided with positive Shut-off and stop valve as specified on drawings
- E. Branch fixture connections shall be as follows with reductions at fixtures as required by terminal outlet or as stated on drawings.

Fixture	Cold	Hot
Water Closet, tank	1/2"	-
Lavatory	1/2"	1/2"

Hydrants	3/4"	-
Special Equipment	As Noted on Plans	-

3.02 PIPING INSTALLATION

- A. Furnish and install piping for every purpose, air unit's drains, and other piping illustrated on the plans and not covered under other headings of these specifications. Where the Contractor is required to make final connections between items of equipment provided and installed by other existing items, he shall use the same class materials and install them in the same manner as specified for the particular system involved or as installed in the existing systems, and he shall have reference to the other sections of these specifications for the class of material and method of installation required.
- B. In general, the materials described under "Products" in this and the following methods of assembly shall be used in fabricating the various listed systems. The methods of assembly may be varied only to meet special conditions, i.e., welding lines where the screwed fitting cannot be installed or vice-versa. Where special classes of piping are involved and are not listed, the contractor shall request exact instructions from the Architect as to the class of material involved and the method of fabricating it before ordering any material. Steel line 2-1/2" and smaller may be assembled by either welding or by screwed fittings as specified.
- C. The locations, directed, and size of water lines, vent lines, drain lines, gas or Propane lines are generally indicated on drawings. Branch connections in general are indicated and shall be so installed as to provide proper grades or level.
- D. Lines shall be made up straight and true at proper grades. Vents and their drains shall pitch down a minimum of 1/8" per foot unless shown otherwise. Pumped water lines shall grade down to drains.
- E. Piping shall follow as closely as possible the route shown on plans taking into consideration conditions to be met at the site. Should any unforeseen conditions arise, lines shall be changed or routed as required after proper approval has been obtained.
- F. Piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which the lines are connected. Expansion compensators shall be installed where necessary to prevent line or water hammer. They shall be secured properly.
- G. Screw joints shall be made with taper threads properly cut. Joints shall be made tight with graphite and oil applied to pipe threads only and not fittings.
- H. All piping shall have reducing fittings used for reducers or increasers where any change in the pipe sizes occur. No bushing of any nature shall be allowed in piping.
- I. Nipples shall be the same size and material as the piping in the systems in which they are being installed, except that close or "all thread" nipples will not be allowed.

- J. Keep open ends of piping, including those extending through the roof, plugged or capped to prevent dirt or other debris from entering the pipe construction. The ends of piping installed shall be thoroughly reamed to full inside diameter of the pipe. A thread lubricant or pipe dope shall be made up of powdered graphite and pure boiled linseed oil, and applied to the male threads only of screwed pipes prior to the installation.
- K. Wherever possible horizontal and vertical runs shall be held as close as possible to the walls, ceilings so as to occupy the minimum space consistent with the proper requirements for insulation, expansion, removal of pipe and access to valves, fittings and unions. Concealed work shall finish off within permitted by the vertical or horizontal chases. Lines shall be graded to permit complete drainage by gravity of piping systems or piece.

3.03 GAS PIPING INSTALLATION

- A. Furnish and installed Crane or approved equal plug type stop cocks in the gas lines, in each branch line or riser serving two or more outlets, and where shown on the drawings specified. An individual stopcock shall be provided at each outlet and a union at the connection to each item of gas consuming equipment. In each case the union shall be installed between the stopcock and the item of equipment served.
- B. All steel gas piping that may come in contact with concrete or the earth shall be protected by 3 mill wrapping applied in accordance with the standard of the local gas company, and field lubricated joints shall be completely sealed and protected in accordance with their standard practices or recommendations.
- C. Furnish labor, materials, equipment and services in connection with the complete gas distribution system and necessary specialties complete, including but not limited to the following:
 - 1. Gas service and connections to all equipment requiring gas.
 - 2. Pressure regulators.
 - 3. Piping and fittings.
 - 4. Control devices.
- D. Requirements of Regulatory Agencies: All work shall conform to:
 - 1. Specified manufacturer's instructions and recommendations.
 - 2. Local, state and national codes and ordinances.
 - 3. American Welding Society (AWS).
 - 4. National Fire Protection Association (NFPA).
 - 5. American Gas Association (AGA).
- E. All piping shall be run straight without sags or traps and shall be so pitched as to drain back to the riser and from the riser to the meter. A drip pocket consisting of a nipple and a cap shall be screwed into the bottom of each riser and at all low points of the gas distributing system.
- F. Provide dielectric couplings wherever piping and fittings of ferrous and non-ferrous metals are joined.

- G. Provide a pressure regulator at each gas-consuming device, or group of devices, where such devices operate at a pressure less than that of the gas supply.
- H. Provide a gas cock in the line leaving the meter. Each branch line and the line to each gas-consuming piece of equipment shall be provided with a gas cock.
- I. Provide venting of the gas meter regulator to atmosphere outside the building. Unions 1 ½" and smaller shall be Grinnell No. 463, or equal. Two inches and larger shall be black malleable iron gasket type flanged unions with proper gasket.
- J. Ground anodes shall be installed as recommended by Gas Company on steel piping underground.
- K. All steel piping underground shall be laid in a bed of sand providing a cover of 6" below, above and to the side of the pipes.
- L. Insulating couplings shall be provided at the gas meter and at the point of entry into the buildings of all gas pipes.
- M. Upon completion of cathode protection installation, the Contractor shall call for inspection by the Owner.
- N. Use a generic term for test in detecting leaks. Complete gas piping system shall be tested with air at a pressure of fifteen (15) PSI and provided tight at such pressure for twenty-four (24) hours or as required by local code authority. Ether or peppermint fumes shall be used to locate leaks. All tests shall be observed by a representative of the Owner before the tests are removed.

3.04 BOXES, PLATES, AND ESCUTHEONS

- A. Unless otherwise specified or shown on the plans, all pushbutton stations for remote control of motors and all manual starters located in finished areas required shall be flush mounted, together with their pilot light stations. The box shall be of a suitable type and size in each case to accommodate the device it is to contain. Provide satin finish stainless steel or dull chrome plated brass cover plates and plate adapters for each of these flush mounted devices.
- B. At each device securely fasten to the wall an identification plate listing the device controlled such as "Supply Fan", "Exhaust Fan", "Heating and Ventilating Units", "Air Units", etc. Identification plates shall be of black with white laminated plastic with the lettering inscribed through a black faceplate into the white backing. All edges of each plate shall be beveled. Plates shall be secured with epoxy and steel screws. Embossed plastic tape will not be acceptable.

3.05 DRAIN PIPING

- A. This system shall consist of piping from the source to a floor drain or hub drain, or other approved point of disposal in the building plumbing system. Final connections to the plumbing system shall be through open sight or indicated trapped connection. Drain lines shall be schedule 40 PVC (refer to Section 2.01/C/3). Horizontal drains shall pitch 1/8" per foot and shall be provided with

plugged tee cleanouts, unless otherwise accessible for cleaning. Fittings shall be the same material as drain piping.

- B. Air conditioning unit drain pans, and other equipment and apparatus which are provided with drain trapping and required to be drained continuously or intermittently as a function of normal operation, shall be provided with drain lines and P-traps whether or not specifically shown on the drawings.
- C. Condensate waste and drain lines shall not be less than $\frac{3}{4}$ inch in internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Primary drain lines may not be manifold together. Condensate drain piping shall be schedule 40 PVC. All condensate piping shall be secured to the A/C platform with Unistrut and pipe clamps so condensate piping is secure where it dumps into the hub drain and will not move beyond the parameters of the hub drain and maintain the required 1" air gap as required by code

3.06 EQUIPMENT CONNECTIONS

- A. Extend waste, water, and gas lines to the various items of equipment as indicated or required, terminating the lines where directed. Make final plumbing connections. Provide shut-off valves and unions at each water and gas connection to each item of equipment requiring same. Furnish P-traps with trap primers as shown on documents for waste connections to equipment.
- B. During the rough-in phase of the work, extend service lines to the various items of equipment terminating them at the proper points for connection to those items of equipment as indicated on detailed drawings of the equipment is being installed or after it is placed, make final connections thereto.
- C. Contractors shall refer to the pertinent provisions of the General Work and the equipment contracts for more specific information on the equipment being furnished.

3.07 TESTING AND ADJUSTING

- A. A final test shall be made after vertical and horizontal soil, waste and vent pipes have been installed and fixtures roughed-in, and before the sewer connection is made. Pipe shall be filled to the top of the vertical lines and allowed to remain so for 24 hours and proved watertight.
- B. Domestic cold and hot water lines shall be tested at 150 lbs. hydrostatic pressure and proved tight. Tests on water lines shall be made before covering or insulation is applied. Exterior gas lines shall be tested at 150 lbs. per square inch and proved tight.
- C. The piping tested above shall be proved tight by the tests. Should any leaks occur, they shall be stopped in an approved manner and the lines re-tested until they prove tight and are acceptable.
- D. In case of any defects, they shall be made good to the satisfaction of the Owner and the work re-tested without delay. Such work shall be done by the contractor without additional charge.

- E. Notice shall be given to the Owner and Inspector before the tests are made and the water or air shall not be drawn off the pipes or the pipes covered until the filled pipes have been examined and approved by the Engineer, Silverleaf PM or the Local Inspector. This Contractor shall adjust all flush valves; stops, flow control fittings, regulators, etc., and put the entire plumbing installation in complete and satisfactory working order. All repairs to piping shall be made by replacing the valves, fittings, and/or pipe proving to be defective. Scratches, wrench marks, etc., on chrome plated lines will be considered defective and shall be replaced without scratches, marks, etc.
- F. The following lines shall be tested at the stated pressure for the length of time noted:

Line	Medium	PSIG	Hours
Domestic & Sprinkler Piping	Water	175	4
Natural Gas	Air	150	1
Soil & Vent Pipe	Water	10"	24
Refrigerant	Dry Nitrogen	450	24

3.08 OPERATING INSTRUCTIONS

- A. A bound manual shall be prepared in duplicate containing complete repair parts lists and operating, service, and maintenance instructions. Contractor shall carefully instruct the Owner's maintenance man during the adjustment and testing period. Contractor shall also, in the presence of the Owner's representative demonstrate the complete operation of each and every piece of apparatus. In the case of the heating and air conditioning equipment, both the heating and cooling functions shall be fully demonstrated at such times as required. Instructional periods shall be for such personnel describing the proper care, operation, and maintenance of equipment.

3.09 ELECTRICAL ITEMS

- A. On equipment requiring electrical connections, furnish and turn over to the Electrical Contractor required and necessary starters, switches, relays, devices, and other appurtenances required (except wiring and raceways). Also furnish complete and approved interlocking and wiring diagrams. The Electrical Contractor shall then set (unless furnished as an integral part of the plumbing equipment or HVAC equipment by the manufacturer) devices and appurtenances and shall completely wire the same in accordance with the approved wiring diagrams. All wiring and conduit for HVAC controls, except for power wiring, shall be by mechanical contractor.
- B. Obtain from the Electrical Contractor the size and types of service to be installed for each and every motor or device furnished under this Division of the work and ascertain that each motor and device is compatible with the service to be installed.

3.10 FOUNDATION AND BASES

- A. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) in conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Owner. All corners of the foundations shall be neatly chamfered. Unless otherwise noted, foundation shall be four inches (4") high. All concrete work performed by the contractors shall conform entirely to the requirements of the General Specifications which describe this class of work.
- B. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical contracts will be extremely objectionable and the contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them; and, consequently, they shall design all foundations, support, etc., for their equipment, and all piping with this end in view. In addition, the contractor shall supervise the construction of all foundations and supports whether they build them or not, in order that they may be constructed in such manner as to prevent the transmission of objectionable noise and/or excessive vibrations.
- C. All equipment having moving parts shall be isolated from the building structures by isolated materials, unless specifically otherwise noted. All isolation shall be the same brand and shall be supplied from the same source. Equipment manufacturers' recommendations shall be followed in the isolation of the equipment.
- D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the base plate, or may be un-housed stable springs.

3.11 MOTORS AND CONTROLS

- A. Furnish and install motors of adequate capacity and suitable speed for proper operation of every piece of equipment requiring a motor.
- B. Mechanical Contractor will furnish a motor controller with pilot light, pushbutton, or as scheduled on the drawings, of adequate capacity and suitable for the proper operation of each and every piece of equipment or apparatus on the drawings. Motors shall be furnished with open-frame, unless otherwise noted, or required by the NEC for the service encountered. Motor starters and electrical devices exposed to the weather shall be NEMA 3 and will be furnished by the Mechanical Contractor for all items as listed on the Mechanical or Plumbing drawings. See Electrical Plans and Specifications to verify requirements.
- C. Motors, unless otherwise noted or herein specified, which are rated ½ HP and over, shall be general purpose, squirrel cage, induction type, arranged for constant speed across-the-line starting, with ball or roller bearing and

constructed and rated in accordance with the latest standards of NEMA for 30 Deg. C., ambient and wound for 3 phase, 60 Hz. power service unless otherwise scheduled, listed, or noted on the mechanical and electrical plans. See Electrical Specifications. Verify job site voltage and power service available before installation of any motors or controls.

- D. Fractional horsepower motors under ½ Hp shall be NEMA constructed and rated, and shall be wound for single-phase operation, unless otherwise noted on schedule. Single-phase motors shall be motor controller with pilot light, where scheduled.
- E. Furnish with each 3-phase motor an across-the-line non-reversing magnetic controller, with three-leg overload and under voltage protection. Construction and rating shall conform to the latest standard of NEMA. Pushbutton stations of "Hand-Off-Auto" switches with pilot lights shall be provided with each starter.
- F. Starters shall be manufactured by Allen-Bradley, General Electric, and Square D and Siemens

3.12 HANGERS AND INSERTS

- A. Hangers, brackets, clamps, flanges, rods, supports, saddles and shields shall be made of standard weight steel for steel and iron piping systems, and copper for copper and brass piping systems. Hangers shall be installed with double nuts. Perforated strap hangers shall not be used in any work.
- B. Pipe hangers and support shall conform to the latest requirements of the ANSI Code for Pressure Piping, B31.1 and Manufacturers' Standardization Society documents MSS-SP-58 and MSS-SP-69, except as supplemented or modified by the requirements of this specification.
- C. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping. Accurate weight balance calculations shall be made to determine the supporting force at each hanger location in order to prevent excessive stress in either pipe or equipment connection. Rigid hangers shall provide a means of vertical adjustment after erection.
- D. Unless otherwise shown on the drawings, horizontal runs of piping shall be suspended from the floor and roof structure, as the case may be, by means of approved hangers spaced not farther apart than as scheduled below. Cast iron soil pipe hangers shall be spaced no greater than five feet (5') on centers.

- E. Hanger rod sizes shall conform to the following schedule:

Pipe up to and including 2"	3/8" rods
Pipe 2-1/2", 3 and 3-1/2"	1/2" rods
Pipe 4" and 5"	5/8" rods

- F. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing

Pipe up to and including 1-1/4	8 feet
Pipe 1-1/2" and 2"	10 feet
Pipe 2-1/2" and 3"	12 feet

Pipe 3-1/2" and 4"	14 feet
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- G. Unless shown otherwise on the plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing:

Pipe up to 3/4" in size	5 feet
Pipe 1" and 1-1/4"	8 feet
Pipe 1-1/2" and larger	10 feet

- H. Concrete inserts shall be continuous slotted inserts may be used to support multiple lines running in close proximity on either individual hangers or on trapeze. Explosive driven anchors will not be allowed.
- I. Vertical risers shall be supported by riser clamps installed at the respective floor lines.
- J. Hangers supporting non-insulated pipe shall be adjustable split ring type equal to: Tolco felt-lined J-Hanger for Copper tubing or PVC Coated J-Hanger for Pipe or conduit.
- K. Hangers supporting insulated pipe shall be clevis type. Hangers shall be installed with insulation protector shields.
- L. Insulation protector shields shall be Fee and Mason Fig. 81. Shields shall be placed between hangers and insulation on all insulated piping systems.
- M. Where anchors are used for copper piping. U-bolts and chains shall be copper plated.
- N. For Horizontal piping along walls, use brackets with hangers and rods as specified.
- O. Supports and hangers shall be installed to permit free expansion and contraction in the piping system. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. Anchors shall be approved by the Engineer and shall be designed for equal effectiveness for both longitudinal and transverse thrust. No piping shall be self-supported from equipment connections. Transmissions of vibration noise shall be considered and any special suspension with vibration dampeners to minimize transmission shall be used where necessary. Shooting of anchors into concrete will not be allowed.
- P. Where ducts interfere with the proper location of hangers, Contractor shall furnish and install trapeze hangers. No hangers shall be installed on duct material for support other than those supporting the duct.
- Q. Pipes serving plumbing fixtures and equipment shall be securely anchored near the point where they penetrate the finish wall. Supports shall be attached to wall or floor construction with clip angles, brackets, or other approved method
- R. In no case shall pipe hangers contact pipe which is to be insulated. Insulation piping shall be supported with appropriate dense insulation, insulated saddles and hangers on the outside of the pipe insulation.

3.13 SCREENS

- A. Provide and install screens on the discharge of each exhaust fan, on each opening above the roof, on the inlet of all intake louvers and caps and openings

furnished under this contract and elsewhere as shown or directed. These shall be ¼" mesh hot-dip galvanized hardware cloth screens set in galvanized frames and securely attached to the openings. Free space openings on screen shall be as required for CFM requirement.

3.14 VENTILATING SYSTEMS

- A. This Contractor shall furnish and install various supply and exhaust system of ventilation indicated to form complete and operating systems and including all ducts, grilles, ceiling supply outlets, registers, control devices, fan motors, drivers, etc., as indicated and as specified hereinafter. These shall include:
1. The various supply systems indicated including air units, air distribution systems, etc.
 2. The various exhaust systems serving the toilet rooms shall consist of ventilators, ducts, registers, etc.
 3. The various exhaust systems serving the various spaces and equipment items and including fitters, fans, ducts, registers, control devices, dampers, etc.
 4. The heaters and exhaust fans on the first and second floor mechanical rooms shall have external thermostats mounted to the walls and set to allow each to operate at given temperatures and not operate at the same time.

3.15 STANDARD CONDITIONS

- A. See plans and specifications for requirements or calculations.

3.16 CLEANUP

- A. Clean up all debris caused by the work of this section, keeping the premises clean and neat at all times.

3.17 HOT WATER CIRCULATION

- A. At any location in the Building where hot water is available from a plumbing fixture the time required for the water to reach the leaving temp from the water heater shall be reasonable. At no time shall required temperature exceed one minute. Hot water recirculation control valves shall be Nibco 1710 DZR brass circuit balancing valves

END OF SECTION

**SECTION 15180
INSULATION**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide specified insulation for control of heat loss or gain, condensation prevention, and sound control.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Painting
- C. Supplementary Mechanical Provisions Section 15010
- D. Basic Materials and Methods Section 15100
- E. Domestic Water Section 15200
- F. Sanitary Waste Section 15300
- G. Refrigeration Section 15650
- H. Air Distribution Section 15800

1.03 QUALITY ASSURANCE

- A. Manufacturers:
 - 1. Insulation:
 - a. Armacell AP/Armaflex SS, AP/Armaflex FS.
 - b. Approved equal submittal required
 - 2. Vapor Barrier Adhesive:
 - a. Indoor:
 - 1. Benjamin-Foster 30-36
 - 2. Approved equal. Submittal required
 - 3. Duct Insulation Adhesive:
 - a. Benjamin-Foster 85-20
 - b. Approved equal. Submittal required
 - 4. Water Pipe Insulation Jacket Adhesive:
 - a. Araflex 520 BLV adhesive
 - b. Approved equal. Submittal Required
- B. Installer: Installer shall have minimum of five years experience in the installation of insulation in work of similar size and scope.
- C. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Mechanical Code with Amendments
 - 3. Local Plumbing Code with Amendments
 - 4. ASTM-E84
 - 5. NFPA-90A

6. U.L. Standard 723

1.04 SUBMITTALS

- A. Submit in accordance with Section 01340, indicated materials, quantities, size, and installation details.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect material in transit and at site. Damaged, deteriorated or wet materials shall be rejected and replaced at the Contractor's expense.

1.06 COOPERATION

- A. Install materials at proper time to keep pace with the general construction and the work of the other trades involved.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. General: Materials shall be manufactured by Knauf, Armstrong, Owens-Corning, and CertainTeed. Materials furnished shall be equal in every respect to that specified. Pre-approval required

2.02 CONDENSATE DRAIN PIPING AND SANITARY PIPING, WHICH RECEIVES CONDENSATE

- A. Condensate drain piping from A/C, units, coil banks, and other items of piping or equipment on all horizontal runs or subject to condensation forming on the surface shall be insulated with ¾" thick Armacell "AP/ArmaflexSS" or "Ap/ArmaflexFS", self sealing or approved equal. Material submittal required. All material used must have a flame spread of less than 25 smoke developed index of less than 50 when tested in accordance with ASTM E 84. Thermal conductivity of 0.27 Btu-in./h-ft² degrees F at a 75 degree mean temperature in accordance with ASTM C 177 or ASTM C 518. Water vapor transmission of 0.008 perm-inches when tested with ASTM 96, procedure A Cover fittings with cut or mitered sections of the pipe insulation. No tape allowed at joints.

2.03 DUCT INSULATION – EXTERNAL

- A. External duct installation shall be either 3" thick glass fiber blanket type insulation of not less than 1 to 1½ lb/ft³ or 4" thick glass fiber blanket type insulation of not less than ½ to ¾ lb/ft³ density with factory applied FSK flame retardant vapor barrier facing. Facing shall consist of a layer of aluminum foil reinforced with fiber glass scrim laminated to UL rated Kraft paper and a

reinforcing layer of fire-retardant adhesive. Permeance shall be 0.02 perms. Insulation shall meet requirements of GREENGUARD Level 4 Microbial Resistant, NFPA-90A, NFPA-90B, UL Standard 723, ASTM E84, ASTM C553, NFPA-255, and UL 723. Insulation shall be equal to Knauf "Duct Wrap". Operating range temperature to +250 °F. The facing shall overlap 2" at all joints and shall be secured with outward clinch staples on 4" centers. All insulation shall have an INSTALLED R-value as set by the Air Diffusion Council of not less than 8.0 in unconditioned spaces and 6.0 in conditioned spaces. Ducts over 30" in width shall have 4" wide strips of adhesive 12" o. c. or mechanical fasteners not more than 18" o. c. applied to the underside. Seal all joints, breaks, fastener penetrations or insulation punctures with adhesive, reinforced with 3" wide vapor barrier strip the same as the insulation facing material being used. No internal duct insulation will be allowed. All insulation shall be Formaldehyde-free. Insulation compression shall be no more than 2.25 for 3" and 3.25 for 4". All duct insulation shall be seamed on the side of ducts no exceptions.

2.04 REFRIGERANT PIPING, VALVE FITTINGS AND FLANGES

- A. Closed cell foam insulation w/solvent weld joints and fittings. Minimum 3/4" ID thick. Insulation shall be equal to Arma-Flex II. No Tape Joints Allowed

2.05 VAPOR BARRIERS ADHESIVE

- A. Indoor: Benjamin-Foster 30-35, or approved equal. Submittal Required
- B. Outdoor: Benjamin-Foster 65-07, or approved equal. Submittal Required

2.06 DUCT INSULATION ADHESIVE

- A. Benjamin-Foster 85-20.

2.07 ADHESIVE FOR WATER PIPE INSULATION JACKETS

- A. Araflex 520 or 520 BLV adhesive

2.08 INSULATION, FITTINGS, AND ADHESIVES

- A. All insulation, fittings, and adhesives shall have a flame spread rating ≤ 25 and smoke developed rated of ≤ 50 when tested by ASTM E84 method.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Apply insulation after surfaces to be insulated are thoroughly cleaned and entire system to be insulated has been tested and proven tight.
- B. Pipe Insulation Supported: All piping systems, which are insulated, shall have pipe insulation protector placed between pipe hanger and insulation to prevent cutting, crushing, or otherwise damaging the insulation or vapor barrier by the hanger. Provide rigid foam glass insulation the same thickness of pipe and insulation protector and seal vapor tight. See Section 15100, "hangers and Inserts".
- C. Insulation must be installed to allow for expansion and contraction.

3.02 DOMESTIC HOT AND HOT RETURN WATER, CONDENSATE PIPING, SANITARY RECEIVING COLD CONDENSATE PIPING

- A. Install Armaflex AP/Armaflex SS or FS closed cell foam insulation in thickness listed below by butting joints firmly and apply adhesive coating to form an isolating seal between jacket and bare pipe at fittings, flanges, and valve.
- B. Adhere longitudinal and butt strips of jacket with vapor barrier Adhesive-Araflex 520 BLV adhesive.
- C. Insulate fittings, flanges and valves with preformed insulation with factory applied vapor barrier. Fittings shall be pre-formed molded PVC with approved flame and smoke ratings.
- D. All primary condensate lines must be insulated. Insulation of any condensate line shall never be less than all horizontal line runs.
- E. On hub and spigot piping, build up insulation at hubs and provide a smooth bevel 2" beyond hub on each side. Pipe insulation shall have thickness as follows:

Service	Pipe Size	Thickness
Domestic Hot and HOT Return	0-1"	$\frac{3}{4}"$
Condensate	$\frac{3}{4}"$ -1"	$\frac{3}{4}"$
Sanitary or Storm exposed within structure, horizontal runs only	All	1 $\frac{1}{2}"$

- F. Insulate all (PEX or Copper) hot and hot water return piping with $\frac{3}{4}"$ thick Armacell "Armaflex". Material used must have a flame spread less than 25 and smoke index less than 50. Used approved adhesive made for joining this material. TAPE JOINTS WILL NOT BE ACCEPTED.

3.03 REFRIGERANT PIPING

- A. Install per insulation manufacturers recommendations. TAPE JOINTS WILL NOT BE ACCEPTED.

END OF SECTION

Insulation
15180 - 5
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**SECTION 15200
DOMESTIC WATER**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide hot and cold water supply lines to fixtures and accessories as required or as shown on the drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Insulation | Section 15180 |
| D. Plumbing | Section 15400 |

1.03 QUALITY ASSURANCE

- A. Manufacturer: See individual items in Part 2 – Products.
- B. Installer: Installer shall have a minimum of five years of experience of installing plumbing systems and equipment of similar size and scope.
- C. Design Criteria: Catalog numbers are for the various manufactures shown.
- D. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Plumbing Code with Amendments
 - 3. ASTM Standards
 - 4. Uniform Plumbing Code

1.04 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Architectural Specifications. Indicate construction materials, finished, sizes, quantities, and related hardware requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect materials in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall be rejected.

1.06 COORDINATION

- A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field dimensions beyond his control.
- B. Consult with others trades in advance and make provisions for their work to avoid cutting and patching.

PART 2 – PRODUCTS

2.01 DOMESTIC WATER PIPE AND FITTINGS

- A. Piping and Fittings:
 - 1. Refer to Basic Materials and Methods Section 15100.
- B. Solder: Lead free
 - 1. Refer to Basic Materials and Methods Section 15100.
- C. Sleeve and caulk all domestic supply water lines where they penetrate concrete slab inside building.

2.02 SHOCK ABSORBERS

- A. Install shock absorbers as indicated on drawings.

2.03 ELECTRIC DRINKING FOUNTAINS

- A. Provide documentation that all solder joints and materials in all drinking fountains are lead free or non-lead bearing. (When applicable)

PART 3 – EXECUTION

3.01 PIPE AND FITTINGS

- A. Securely anchor all hot water lines where directed. Provide expansion loops in hot water lines where necessary. No bushings are allowed
- B. Install all hot and cold water lines with grade from high to low point:
 - 1. Provide drain valves at low point.
 - 2. Install free of traps.
- C. Valve Locations:
 - 1. Install main hot and cold water lines as indicated on drawings and in each unit at each branch take-off from main lines.
- D. Positive Shut-Off Valves:
 - 1. In each branch line serving hose bibbs, etc.
 - 2. To expedite replacement or repair.
- E. Branch fixture connections shall be as follows with reductions at fixtures as required by terminal outlet, or as noted on drawings.
 - 1. Hot and cold water to lavatories, tubs and water closets will be “Brass Craft” ¼ turn ball stop.

2. Terminate cold with $\frac{1}{4}$ turn dual outlet for kitchen sink cold water and refrigerator icemaker.
3. All flex supply lines to be Watts Fluid Safe Series stainless steel flex supply lines.
4. Pex tubing valve termination in stud walls shall use LSP PKits for faucet and toilet - 02

Fixture	Cold	Hot
Water Closet, Tank	$\frac{1}{2}$ "	-
Lavatory	$\frac{1}{2}$ "	$\frac{1}{2}$ "
Hydrants	$\frac{3}{4}$ "	-
Special Equipment	As Noted	-

3.02 CLEANING

- A. Thoroughly clean ends of pipes before sweating joints:
 1. Inside and out

3.03 ICE MAKER CONNECTION BOX

- A. Provide as per/drawing's. Do not install on any exterior wall.

END OF SECTION

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**SECTION 15300
SANITARY WASTE**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide a waste, soil, storm drainage, and vent piping system to serve the fixtures and other related equipment and accessories, as indicated and specified. Provide all labor, materials, equipment, tools and services and perform all operations required in connection with incidental to the construction of complete sanitary drainage systems as indicated on the drawings, reasonably implied there from or as specified herein unless specifically excluded.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Insulation | Section 15180 |
| D. Plumbing | Section 15400 |

1.03 QUALITY ASSURANCE

- A. Manufacturer: As indicated on drawings.
- B. Installer: Installer shall have a minimum of five years experience in installing of plumbing systems of similar size and scope.
- C. Design Criteria: Proposed substitutions shall be approved only by owner in accordance with Architectural Specifications.
- D. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Plumbing Code with Amendments
 - 3. ASTM Standards
 - 4. Uniform Plumbing Code
 - 5. Florida Building (Plumbing) Code
- E. PVC piping underground shall be imbedded in 6" sand, covered with crushed rock fill to a depth of not less than 36". All PVC waste lines under concrete or asphalt shall be schedule 40. All is allowed where permitted by code. Only DWV with the ASTM stamp D1785 and D2665 conforming to 220psi @73 F for 4" PVC or 180psi @73F for 6" PVC will be allowed. No Foam Core, Cellular Core or Schedule 10 PVC

1.04 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Architectural Specifications. Indicate construction materials, finishes, sizes, quantities, and related hardware requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during installation shall be rejected.

1.06 COORDINATIONS

- A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.
- B. Consult with others trades in advance and make provisions for their work to avoid cutting and patching.

PART 2 – PRODUCTS

2.01 PIPE

- A. Sanitary and storm piping to a point within 5 feet of the exterior wall, under exterior paved areas, and under building slab:
 - 1. Only DWV with the ASTM stamp D1785 and D2665 conforming to 180psi @73 F for 4" PVC or 220psi @73F for 6" PVC will be allowed. No Foam Core, Cellular Core or Schedule 10 PVC
 - 2. Manufacturer's name and type, on cast pipe.
 - 3. No steel or ferrous piping allowed for waste lines.

2.02 FITTINGS

- A. Soil and vent pipe:
 - 1. Solvent weld-see Specifications Section 15100
- B. Connections between traps and soil pipe.
 - 1. Provide all reducers, increasers, special flanges, and fittings, etc., where and as required. No bushings are allowed on any type of sanitary or vent piping.

2.03 CLEANOUTS

- A. Cleanouts shall be located at the bottom of headers according to documents.
- B. All wall cleanouts shall be flush with exterior of wall w/cap. A chrome face plate shall be used to cover the cleanout and not protrude any from the wall. The

cleanout shall not be mounted so as to interfere with base boards or locate outside of the cabinet if located within confines of the cabinet, A hole shall be cut in the back of the cabinet to allow access to cleanout. Hole shall not exceed twenty five percent of plate cover size.

2.04 FLOOR DRAINS

- A. See plumbing fixture schedule on project documents.

2.05 FLASHINGS

- A. Install with roofing contractor type of flashing devices compatible with roofing system actually installed or as detailed on project documents and approved by local code.

PART 3 – EXECUTION

3.01 SOIL, WASTE AND VENT PIPING AND FITTINGS

- A. Soil Pipe Joints Above Ground: solvent weld watertight.
- B. Joints under Floor or Underground: solvent weld watertight.
- C. Vent Piping:
 - 1. Install as indicated on the plans with the vents extending and flashed through the roof.
 - 2. Piping shall be assembled and installed without undue strains and stresses.
 - 3. Make provisions for expansion, contraction, and building settlement or pipe movement.
- D. Sanitary Piping:
 - 1. Grade uniformly to the outside sewer connections with fittings and connections installed in accordance with the local plumbing code or ordinances.
 - 2. In no case shall the grade for horizontal piping be less than a uniform grade of $\frac{1}{4}$ " per foot for 2-1/2" piping and smaller, and not less than $\frac{1}{8}$ "foot for 3" to 6" pipe.
 - 3. Changes in pipe sizes on soil, waste and drain lines shall be made with reducing fittings not bushings. Changes in direction shall be made by 45-degree wyes, half wyes, long-sweep $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, or $\frac{1}{16}$ bends. Sanitary tees may be used on vertical stacks, and short $\frac{1}{4}$ bends or elbows may be used in soil and waste lines where change in flow direction is from horizontal to vertical, and on the discharge from water closets.

3.02 REVENT STACKS

- A. Shall be the maximum required size throughout the entire length.

- B. Shall be connected into the waste stack by means of a wye and 1/8" bend below the lowest trap vented by it.
- C. Install trap vented by it.
- D. Accessories and appurtenance shall be of the same material as pipe.
- E. Entire installation shall be installed in strict accordance with the manufacturer's directions.

3.03 TRAPS

- A. Trap Locations:
 - 1. Placed as near to the fixture as possible.
 - 2. No fixture shall be doubled trapped.
- B. Traps installed on threaded pipe shall be recess drainage pattern.
- C. Fixture trap venting shall be individually back vented except where specifically shown or noted otherwise on the Drawings.
- D. Provide the proper "P" trap for each drain. Floor drains shall be deep seal traps installed with trap primer. Any floor drain to daylight on outside of structure shall be protected by bug screens at outlet so as to prevent pests as small as mosquitoes or ants from entering drain.

3.04 CLEANOUTS

- A. Connection box shall be LSP – OB – 2131 – C Cleanout Locations:
 - 1. Distance between cleanouts in horizontal lines shall not exceed 100 feet.
 - 2. Distance between cleanouts on the exterior of the building shall be spaced at no more than 100 feet.
 - 3. Cleanouts shall be installed as per project drawings in accessible locations
- B. Cleanout Sizing: Cleanouts shall be of the same size as the pipe with which they are installed up to 4" and 4" in size for larger piping.
- C. Cleanouts in walls or floor of finished areas:
 - 1. Cleanouts shall be provided with heavy cast brass plugs with countersunk head and stainless steel tops or access plates. Zurn 2-1420-2
 - 2. Each access top or plate shall be engraved and embossed with approved letters or name of the service for which it is used. Zurn 2-1420-9

3.05 HUB DRAINS

- A. Install in locations shown on the drawings.
- B. Size as shown on the drawings
- C. Set top of strainer level with finished floor
- D. Floor drains for use in tiled and finished areas shall be similar to Josam Series 30000-EI cast-iron floor drain with double drainage flange, weep holes, bottom outlet, flashing-clamping device and nickel chrome adjustable strainer or approved equal.

- E. Hub portion of drain shall extend a min. of three (3) inches above finished floor.
Hub drains shall bell open at inlet above floor to a min. of 6"

3.06 VENTS

- A. Vents not sized on the drawings shall be sized, collected, and terminated in the attic section of the building.
- B. In no case shall the vent piping be smaller than what is specified on the drawings or less than code.

END OF SECTION

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**SECTION 15400
PLUMBING**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide items of plumbing related equipment, and accessories as indicated and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Domestic Water | Section 15200 |
| D. Sanitary Waste Water | Section 15300 |

1.03 QUALITY ASSURANCE

- A. Manufacturer: As indicated on drawings.
- B. Installer: Installer shall have a minimum of five years experience in installing of plumbing systems of similar size and scope.
- C. Design Criteria: Catalog numbers are for the various manufacturers shown.
- D. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Plumbing Code with Amendments
 - 3. Uniform Plumbing Code

1.04 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Specifications. Indicate construction materials, finishes, sizes, quantities, and related hardware requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during installation shall be rejected.

1.06 COORDINATIONS

- A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field

measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.

- B. Consult with others trades in advance and make provisions for their work to avoid cutting and patching.

PART 2 – PRODUCTS

2.01 GAS PIPE AND FITTINGS

- A. Piping and Fittings: Refer to Basic Materials and Methods, Section 15100

2.02 PLUMBING FIXTURES

- A. See Plumbing Fixture Schedule on Project Documents. No substitutions will be allowed. See Arch. Drawings for correct handle location on toilet tanks per building layout.
- B. Plumbing Fixtures: Fittings shall be chrome-plated where exposed. Provide tight escutcheons of chrome-plated where pipes pass through floor, wall or ceiling. All porcelain or vitreous china shall be clean, smooth and bright. All shall be warranted not to craze, color or scale. Hot and cold water supplies shall have chrome-plated brass stops as specified. All plumbing fixtures shall have chrome-plated brass stops as specified. All required fittings, mounting flanges, carrier, caps, setting compound, piping, valves, etc. for complete plumbing installation will be furnished by the plumbing contractor.

2.03 DOMESTIC WATER HEATERS

- A. Water heaters shall be glass lined, steel tank, electric, gas or propane units, sized as scheduled. Units shall be complete with fiberglass insulation; protective sheet metal jackets with baked enamel finish, immersion type electric heating units and thermostats, removable without draining the tank, adjustable thermostatic control, high temperature safety cutout, T&P relief valve, and protective devices as required by code. Heater tanks shall be fabricated so that the water will not come in contact with any ferrous metals and the tanks shall have a minimum guarantee of 100% replacement for the first five years. Proof of five year warranty and purchase shall be from manufacture and verified by letter to be inserted in Warranty Manual. The entire unit shall bear the UL label. See Plumbing Schedule on Drawings for Type and Size. Heater temperature shall be set at 115 degrees Fahrenheit with the circulator running.

PART 3 – EXECUTION

3.01 INSTALLATION GENERAL

- A. Provide competent foreman or supervisor for the installation of the equipment and to counsel other trades in regard to connection and installation. Install

equipment level and square in proper lanes with other work, secure anchorage in place. Test operation of project, provide full instructions and demonstrate to the Owner's designated representative the proper methods of care, operations, and maintenance of the equipment. Traps shall be installed as close to fixture as possible.

3.02 EQUIPMENT INSTALLATION

- A. Install water heaters in accordance with Drawings and maintenance requirements of elements replacement. Install the relief valve so that the bulbs will be immersed in the tanks. Pipe relief valve outlet full size to the nearest floor drain or hub drain. Heaters shall be installed so that elements and relief valves can be replaced without turning or disconnecting equipment to replace such. At no time shall they be placed in line with any part of the building structure that will require the building to be modified to remove elements or relief valves.
- B. Wall hung fixtures shall be rigidly supported by approved chair carriers, etc., and floor outlet fixtures shall be rigidly secured and bolted to the floor.
- C. Exercise care in fabricating plumbing lines to avoid all cross-connections and to construct the piping systems in a manner, which eliminates the possibility of water contamination.
- D. The piping systems have been designed in every case to avoid the possibility of reverse flow or back-siphoning. Construct plumbing lines to make certain that not only the letter, but the spirit of these safety precautions is carried out to the fullest possible extent.
- E. Provide back flow preventers, where necessary or as required by drawings. Provide brand type and model as per listing on drawings. In any case it shall be the contractor's responsibility to adhere to local code requirements without any cost to the owner. Backflow preventers shall be located in mechanical room of first occupied living floor.
- F. Provide all necessary vacuum breakers as required by the local code or uniform plumbing code.
- G. Install all plumbing drains, vents, waste or water lines so as not to conflict with any locations of electrical boxes, supply air ducts, return air ducts or A/C filters locations. All plumbing vents or drain lines which have been installed next to building studs or any wood which is to receive drywall must have metal plates protecting the lines installed. The metal protection plate must run the entire length of the pipe which is to be protected. The pipe must be farther than 1 1/2" away from the wood at the outer edge of the pipe in order to not require the metal protection.
- H. After water closet stubs have been installed cover all stub openings with cardboard attached to the closet flange. Set spacers for proper flange height according to what is needed for the pouring of the gypcrete.
- I. All P-traps that serve sinks mounted in tops of cabinet structures shall

be installed under the sink in the cabinet. No P-traps for this type of install can be mounted in the truss space of the building.

END OF SECTION

**SECTION 15500
FIRE PROTECTION**

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. The Sprinkler System Installing Contractor (herein referred to as the Contractor) shall design, furnish and install all necessary equipment to provide a complete automatic fire sprinkler system throughout as indicated and described on the contract drawings and in this specification.
- B. At the time of bid, all exceptions taken to these Specifications, variances from these Specifications and all substitutions of equipment specified shall be listed in writing and forwarded to the General Contractor. Any such exceptions, variances, or substitutions, which were not listed at the time of bid and are identified in the RFI submittal through the General Contractor, shall be grounds for immediate disapproval without comment.
- C. Any equipment proposed as equal to that specified herein shall conform to the standards herein, and the manufacturer shall supply proof of having produced similar equipment, now giving satisfactory service. In addition, the Contractor shall obtain the approval of the Owner in writing ten (10) working days prior to bidding equipment other than that which is specified by RFI through the General Contractor. The manufacturer's name, model numbers, and number of copies of all equipment drawings and engineering data sheets necessary for a complete review shall be submitted for approval, in accordance with this specification. Included in the RFI submittal shall be a written statement indicating compliance with the features, functions, and performance of the specified equipment and the applicable codes.

1.02 QUALITY ASSURANCE

- A. This specification identifies the essential functional requirements of the automatic sprinkler system. The manufacturer's equipment and system configuration shall comply with or exceed the functional intent of this specification.
- B. Sprinkler Components: Listing and labeled by a testing agency for the intended use and acceptable to Owner and the authorities having jurisdiction.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- D. All materials and equipment shall be new and unused.
- E. All equipment supplied shall be first quality and the manufacturer's best type and latest model capable of complying with all requirements of this specification and shall have been in continuous production and in continuous service in commercial applications for at least one year. Obsolete equipment shall not be

allowed. Any obsolete equipment will be removed by Contractor at Owner's request and current equipment shall be installed at no cost to Owner.

- F. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner through the General Contractor by RFI.

1.03 SCOPE OF WORK

- A. The automatic fire sprinkler system shall be a hydraulically calculated, automatic sprinkler system. The project includes the design, fabrication and installation of a complete, ready, and operational sprinkler system throughout the building, as specified herein and indicated on the drawings including, but not limited to the following: required fire pumps and associated control systems, hose cabinets, fire extinguishers, air drying systems (refrigerated), air compressors (oil less), any required signage, Knox box, hoses, FDC exterior connections, escutcheons, water gong or electronic gong, piping, fittings, hangers, sprinkler heads of all types as described on drawings, check valves, control valves, backflow preventer, drain valves, water pressure gauges, floor control assemblies, alarm and supervisory devices, and hose connections
- B. The work described in this specification shall consist of all labor, materials, services, tools, transportation, and temporary construction necessary to design, fabricate, install, test and flush the operational automatic fire sprinkler system.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor's responsibilities include the following:
1. Survey the site to determine the existing conditions and the extent of the work.
 2. The installation of a complete, ready and operational automatic fire sprinkler system. The system installation shall include, but not be limited to:
 - a. Installation of the automatic sprinkler system from the point of connection (see Civil Drawings) throughout the building.
 - b. Verification of the water supply information. Contractor shall verify that the water supply flow test information is acceptable to the authority having jurisdiction as a basis of design. If any new tests are required, the contractor shall conduct the tests with no additional cost to the Owner. Preliminary water supply information based on a water flow test conducted is noted on drawings.
 - c. Provide wall-mounted or free-standing fire department siamese connections (FDC's) with check valve and ball drip, connected to system piping.
 - d. Installation and location of all sprinkler system risers, mains and branch line piping in concealed spaces, such as ceilings and walls. Sprinkler piping in equipment rooms and storage rooms shall be permitted to be exposed. The locations of any necessary

- core drilling through walls or floors shall be coordinated and approved by the Owner prior to drilling.
- e. Determination of all pipe sizes by hydraulic calculations in accordance with NFPA 13. The Contractor is responsible to verify that field modifications to the system, which require the addition of fittings and piping, do not affect the hydraulic demand of the automatic fire sprinkler system.
 - f. Determination of all pipe cut lengths and fitting take-out dimensions prior to pipe fabrication.
 - g. Installation and location of all water flow and valve supervisory switches. Valve supervisory switches shall be provided for all valves controlling any portion of the automatic fire sprinkler system. Contractor shall be responsible to coordinate with the fire alarm contractor or electrical contractor for the connection of the water flow and valve supervisory switches to the building fire alarm system.
 - h. Installation and location of all required drain valves, drain lines, inspector's test connections, pressure gauges and signs to identify all valves. Pressure gauges shall be provided on both sides of riser check valves. Contractor shall coordinate the location of all drain valves; drain piping, and inspector's test connection with the Owner prior to fabrication and installation. All inspector's test connections and drains shall be hard-piped to the building drains or to the building exterior, and shall terminate 12 inches above grade in a location acceptable to the Owner. All inspectors test valves, drain valves and drain piping, shall be pitched according to code to the mechanical rooms, and not be imbedded in an exterior or interior wall requiring an access panel on exterior or interior to gain access to the valve. All valves for main drain lines shall be located in mechanical room and exposed in room for access. Discharge test lines shall be thru outside wall of first floor mechanical room at rear of building.
 - i. Installation and location of all sprinklers. Contractor shall coordinate the exact location of sprinklers within finished areas with the Owner prior to the installation.
 - j. Installation of a Knox box and all signage as required by NFPA and the authority having Jurisdiction.
3. The development of working drawings (as defined by NFPA 13) for the automatic fire sprinkler system in accordance with applicable codes, cited in this specification. The Contractor shall submit working drawings for:
- a. Review and approval by the Owner (Note: Drawings shall not be submitted to the authority having jurisdiction until approved in writing by the Owner.)
 - b. Submission to the authority having jurisdiction for review, permit issuance, and approval for installation.

- c. Field installation of the automatic fire sprinkler system, after the Owner and the authorities having jurisdiction have reviewed and approved the drawings and submittals, and the permit for the installation of the automatic fire sprinkler system has been issued.
4. The preparation of a minimum of six complete submittal packages identifying the quantities and technical information for all materials and equipment to be provided. Complete manufacturer's technical specifications shall be provided for all substitute components to those identified in these specifications. Substitutions must be approved in writing by Owner prior to installation or purchase.
5. Payment of all permit fees required for the installation of the automatic fire sprinkler system and obtaining all permits from the authorities having jurisdiction shall be the contractor's responsibility.
6. Coordinating the installation of the fire sprinkler system and testing of associated equipment and appurtenances with all related trades, contractors, equipment maintenance and testing representatives, the Owner and the authorities having jurisdiction. Where applicable, work and/or equipment provided in other sections and related to the automatic fire sprinkler system shall include, but not be limited to:
 - a. Sprinkler water flow and valve supervisory switches. The Contractor shall be responsible for installing the switches. The Contractor shall coordinate and verify the quantity and location of all switches with the installing fire alarm contractor or electrical contractor.
 - b. Power. The Contractor shall coordinate and verify the location and power requirements of all equipment with the installing electrical contractor.
7. Recording of all field changes to working plans and preparation of as-built drawings, showing all field changes to the working drawings.
8. Training of Owner's personnel as described herein.

1.05 SPRINKLER SYSTEM DESIGN CRITERIA

- A. The automatic fire sprinkler system shall be designed in accordance with the following:
 1. Ordinary Hazard Occupancy Areas (including Storage and Equipment / Mechanical Rooms): pipe sprinkler system serving ordinary hazard occupancy areas, including equipment / mechanical spaces and storage areas, etc., shall be designed in accordance with the Density / Area method referenced in NFPA 13. The sprinklers in these areas shall be designed for 130 square feet maximum sprinkler spacing. The Contractor shall utilize the minimum flow requirements and minimum sprinkler operating pressure in hydraulic calculations for the sprinklers. Sprinklers shall be nominal 155°F temperature rated sprinklers, white or brass finish, and cage-guarded. The hydraulic calculations shall include the hose stream allowance required by NFPA 13.

- B. Pipe sizing shall be determined by hydraulic calculations in accordance with NFPA 13 requirements, and shall be based upon a water flow test performed by the Contractor at the site.
- C. Sprinkler systems shall be designed according to the following:
 - 1. Minimum density for automatic fire sprinkler / standpipe piping design:
 - a. Ordinary Hazard, Group 1 Occupancy: 0.15 gpm per square foot 1500 sq. ft. area.
 - b. Design areas shall be modified as necessary to comply with the requirements for specific building features identified in NFPA 13.
 - c. Sprinklers shall utilize the minimum required discharge pressure and flow as indicated in the UL listing of the sprinkler for the specific spacing.
 - 2. Maximum Protection Area per Sprinkler:
 - a. Ordinary Hazard Areas: 130 sq. ft.
 - b. Extended Coverage Sprinklers: As noted in the UL listing.
 - 3. The Contractor is required to calculate pressure losses due to elevation and friction losses through all fittings, piping, and valves in accordance with NFPA 13.
 - 4. Hose Allowance:
 - a. Light Hazard Areas: 100 gpm combined inside and outside hose allowance.
 - b. Ordinary Hazard Areas: 250 gpm combined inside and outside hose allowance.
 - 5. Safety Factor: The hydraulic calculations shall incorporate a margin of safety of 10 percent with respect to the residual pressure. This shall be above the required sprinkler system demand pressure at the calculated system design flow including hose allowances. Calculations shall demonstrate that the maximum velocity in piping does not exceed 25 feet per second.
- D. Components and Installation: Capable of producing piping systems with 300-psig minimum working-pressure rating, unless otherwise indicated.

1.06 QUALIFICATION OF BIDDERS

- A. All contractors connected with the captioned project shall provide proof of competence of both their company and the individual foreman that will be assigned to this project. The Contractor shall have been in the business of installing automatic fire sprinkler systems for at least ten (10) years, acceptable to the Owner. Once assigned, the Contractor's foreman shall not be changed without the approval of the Owner.
- B. The Contractor shall be licensed by the applicable State and experienced in the installation of automatic fire sprinkler systems in similar buildings and has obtained design and inspection approvals for similar projects from authorities having jurisdiction
- C. The Contractor shall have on-staff a professional engineer (or minimum NICET Level III certified technician) who is legally qualified to practice in State and is

experienced in providing fire protection engineering services. The professional engineer (or minimum NICET Level III certified technician) shall perform and be responsible for the design of the automatic fire sprinkler system. Engineering services are defined as those performed for installations of automatic fire sprinkler systems that are similar to those indicated for the project in material, design, and extent.

- D. Each proposed bid shall be professionally presented, be bound and shall include a title page and index.
- E. As a minimum, all bidding contractors shall include the following in the automatic fire sprinkler system bid to the General Contractor:
 - 1. The names and qualifications of the Contractor's and the equipment supplier's foreman, project manager and project engineer who shall be in responsible charge during the entire project installation. Contractor's and supplier's qualifications shall include years in business, service policies, warranty definitions and prior experience with installations that include the type of equipment that is to be supplied.
 - 2. A list of at least three (3) similar installations with addresses of properties, contact names and types of system equipment installed.
 - 3. The price for the systems as specified, the prices for required and recommended alternatives for equipment, service work not included in the warranty and prices for a service contract. The prices for engineering, fabrication and on-site installation of each system shall include all subcontractor and manufacturer's on-site representative labor costs. The Contractor shall list all deviations and/or exceptions to these specifications as proposed alternatives.
 - 4. Completed pricing shall be accompanied by equipment manufacturer's product data sheets for the major components of the proposed system (sprinklers, piping, fitting, valves, etc.).
 - 5. Nonconformance to the Qualification of Bidders requirements outlined in this specification shall be cause for immediate dismissal of the Bid Documents without comment.
 - 6. The contract shall be awarded based on the submitted information and all considerations in the best interests of the Owner. Once the contract is awarded, no requested changes for equipment, suppliers or subcontractors shall be accepted unless justification is made in writing. Once as-signed, the Contractor's foreman and the technicians shall not be changed without the approval of the Owner. Upon written request from the Contractor, the Owner may authorize changes, but at their sole choice and discretion. The Contractor shall be at risk for any attempt to substitute the equipment suppliers or subcontractors accepted. All cost for removal, relocation, or replacement of a substituted item shall be at the risk of the Contractor.

1.07 CODES AND STANDARDS

- A. The automatic fire sprinkler system shall comply with all applicable state and local codes, including the International Building Code as adopted and amended by the local jurisdictions, the International Fire Code as adopted and amended by the local jurisdiction, the National Fire Codes, as referenced and modified by the applicable building and fire codes.
- B. All equipment and devices shall be labeled and listed for the intended use in Underwriters Laboratories, Inc. (UL), UL FPED Fire Protection Equipment Directory.
- C. If a UL listing for a specific device is unavailable, approval by FM Global (FM) or other nationally recognized testing laboratory (NTRL) acceptable to the Owner shall be acceptable.
- D. Installation shall be made in accordance with applicable provisions of the latest published edition of the following:
 - 1. International Building Code, as adopted and amended by the local jurisdiction.
 - 2. International Fire Code, as adopted and amended by the local jurisdiction.
 - 3. NFPA 13, Standard for the Installation of Sprinkler Systems.
 - 4. NFPA 25, Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
 - 5. NFPA 70, National Electrical Code, as adopted and amended by the local jurisdiction.
 - 6. NFPA 72, National Fire Alarm Code.
 - 7. NFPA 101, Life Safety Code, as adopted and amended by the local jurisdiction.
 - 8. Underwriters Laboratories, Inc. (UL), UL FPED, Fire Protection Equipment Directory.
 - 9. The latest published edition of the equipment manufacturers' product datasheets, technical specifications, and installation instructions and guidelines.
- E. The systems shall be tested in accordance with the following:
 - 1. NFPA 13, Standard for the Installation of Sprinkler Systems.
 - 2. NFPA 25, Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
 - 3. NFPA 70, National Electrical Code.
 - 4. NFPA 72, National Fire Alarm Code.
 - 5. The latest published edition of the equipment manufacturers' testing procedures and guidelines.

1.08 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary, apply to this Section.
- B. Drawings supplied with this specification shall be used by the Contractor as a reference for the requirement and location of system components. It shall be the responsibility of the Contractor to visit the site, observe the existing

conditions, and confirm the required quantities of devices and specific options for locations of the same.

- C. Documents, including shop drawings, hydraulic calculations, and material specifications prepared according to NFPA 13, shall be required for obtaining approval by the Owner and the authorities having jurisdiction.
- D. The requirement of building permits and authorization to proceed shall become part of this specification. The permits and authorization to proceed shall be obtained and paid for by the Contractor, where applicable.
- E. Prior to commencement and after completion of work, the Contractor shall provide written notification to the authorities having jurisdiction.
- F. The Contractor shall notify the Owner, in writing, when the system is ready for the Demonstration Test and the Acceptance Test. Notification shall be a minimum of one (1) week in advance of the planned tests. The system shall be considered ready for the Demonstration Test, only after all preliminary tests have been made by the Contractor, and all deficiencies have been found and corrected. In addition, two (2) copies of the Contractor's Materials and Test Certificate shall be submitted to the Owner before Owner shall agree to the scheduling of the Demonstration Test.

1.09 ORDER OF PRECEDENCE

- A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:
 - 1. State and local codes shall take precedence over this specification.
 - 2. The National Fire Protection Association Standards shall take precedence over this specification.
 - 3. This specification shall take precedence over the drawings.

1.10 SUBMITTALS

- A. By submitting a proposal to conduct the work as described in these specifications and the accompanied design documents, the Contractor agrees that he has reviewed the documentation to verify dimensions, quantities, installation techniques, and good workmanship and safety precautions and that he understands said documents relative to this project including the applicable referenced local, state and national Codes, Standards and Regulations. Further, the Contractor agrees that he is familiar with the building layout and understands that the automatic fire sprinkler system shall be installed in accordance with the herein referenced documents.
- B. The Contractor shall certify in writing that the submittal documentation is in conformance with all of the requirements of this specification and the applicable referenced local, state and national Codes, Standards and Regulations.
- C. The Contractor is responsible to prepare and submit a minimum of six copies of submittals for approval. Each submittal package shall be prepared and

presented in a professional manner, be bound and shall include a title page and index. Each section of the submittal shall be numbered. Submittal packages shall be complete. Partial submittal packages will be returned without review. System working plans (as defined in NFPA 13) and calculations must be prepared and submitted for approval, by a registered professional engineer or a minimum NICET Level III certified technician who is legally qualified to practice in the applicable State.

- D. The Contractor shall not order any equipment and shall not begin any work until the submittals have been approved in writing by the Owner and the authorities having jurisdiction. The Contractor shall not perform any installation prior to the receipt of approved submittals from the Owner and Engineer, and receipt of a written permit to proceed by the authorities having jurisdiction.
- E. The Owner shall review these documents for the limited purposes of checking for general conformance with the design and not to determine accuracy or completeness of other details such as dimensions and quantities. The Owner shall not approve means, methods or procedures of construction or installation; nor shall they review for safety precautions.
- F. If submittals are found not to conform to all of the requirements of this specification and the applicable referenced Codes, Standards and Regulations, the Contractor shall be required to revise and re-submit the package with modifications. Delays shall not cause extension of time or money to any contracts.
- G. In the event that the Contractor's submittal package is required to be revised and re-submitted due to nonconformance with this specification, illegibility of the submittal, incomplete submittals, noncompliance with the referenced Codes, Standards and Regulations or nonconformance with pertinent documentation relative to the project, the Contractor shall pay all fees associated with the additional submittal review. Payment of the fee shall be solely the Contractor's responsibility.
- H. Prior to performing any work, the Contractor responsible for the automatic fire sprinkler system installation shall include the following documentation in addition to those documents required elsewhere in this specification:
 - 1. Sufficient information to describe their qualifications, the work efforts to be performed, and the materials to be provided, including the names and qualifications of the Contractor's and the equipment supplier's project manager and project engineer who shall be in responsible charge during the entire project installation. Contractor's qualifications shall include years in business and prior experience with installations that include the type of equipment that is to be supplied.
 - 2. The manufacturer's technical representative's name and qualifications. Once approved, the representative shall not be changed without approval in writing by the Owner.
 - 3. A schedule indicating the delivery dates of the equipment to be supplied; installation sequence; time frame and the total amount of on-site technical assistance time (in man-hours per phase) that the supplier of the equipment has included in their bid to comply with the requirements of this

specification and the Owner's requirements; and demonstration test and final test/acceptance dates to meet the Owner's scheduled project completion dates.

4. Written confirmation of how the manufacturer/supplier plans to comply with the performance operational design of the system and all pertinent information regarding the reliability and operation of the equipment to be supplied.
 5. A letter from the equipment manufacturer stating that the equipment to be supplied is not at or near the end of its life cycle and those replacement components for all control equipment shall be available from the manufacturer for a minimum of 15 years from the date of installation.
 6. A preliminary Equipment List identifying the type, quantity, make and model number of each piece of equipment to be provided under this submittal. The Equipment List shall include the type, quantity, make and model of spare equipment, as specified in this specification. Types and quantities of equipment submitted shall coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings. A final Equipment List shall be submitted with the Operating and Maintenance (O&M) Manual, as specified in this specification.
 7. Manufacturer's original product datasheets, specifications, installation instruction sheets and descriptive information for all major components of the system. Copies shall not be acceptable. All equipment and devices to be furnished under this contract shall be clearly marked (highlighted) on the product datasheets.
 8. Appropriately scaled Working Plans (in accordance with NFPA 13) shall be submitted including a riser diagram of the complete automatic fire sprinkler system and complete details as necessary.
 9. Complete hydraulic calculations for all areas of the buildings to justify pipe sizing and routing. New hydrant flow test information shall be provided if necessary.
 10. Proof of insurance consistent with the Owner's requirements.
- I. Equipment other than specified shall be considered for approval. It shall be the Contractor's obligation to submit data and information to allow the Owner time to consider the equality of the substituted items to that specified. It is the Contractor's responsibility to meet the entire intent of the specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of substantial completion of the project and acceptance by the Owner. Accepted submittals on substitute equipment shall only allow the Contractor to proceed with proposing a substituted item and shall not be considered equal until such time as the Owner has completely accepted the substitute item. The Contractor shall provide the following in writing to the Owner a minimum of ten (10) days before the submittal date:
1. Complete lists, descriptions, and drawings of materials to be used.
 2. A complete riser diagram of the automatic fire sprinkler system.

3. All pertinent information regarding the reliability and operation of the equipment to be supplied.
 4. Manufacturer's original product datasheets, specifications, installation instruction sheets and descriptive information for all major components of the system.
- J. The Owner may request a demonstration of the proposed equipment.
- K. The Contractor and the equipment supplier shall advise the Owner of all anticipated projects that have the same approximate completion dates as this project and what impact they shall have on the timely completion of this project.
- L. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- M. Maintenance Data: Contractor shall provide a complete maintenance manual for each system. The maintenance manual shall describe in detail the purpose and function of all system devices and valves and inspection, testing and maintenance forms. Contractor shall provide owner with one (1) copy of the latest edition of NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, in addition to the maintenance manual. All maintenance data shall be given to the General Contractor for inserting in the building maintenance manual.

1.11 SCHEDULING

- A. The Contractor shall provide a schedule to the General Contractor indicating the installation sequence and time frame prior to beginning work. The Contractor shall provide weekly updates to the General Contractor. It is the Contractor's responsibility to have all installation and testing completed in time for the equipment supplier to make all final connections and conduct all tests as outlined in these specifications.
- B. The Contractor shall be responsible for coordinating the Demonstration Test for the automatic fire sprinkler system with the Owner through the General Contractor.
- C. The Contractor shall be responsible for coordinating the Acceptance Test for the automatic fire sprinkler system with the Owner and the authorities having jurisdiction through the General Contractor.

1.12 SPARE PARTS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Furnish and install one (1) red steel cabinet with hinged cover located in first occupied floor mechanical room, with a minimum of ten spare sprinkler heads plus sprinkler wrench. Cabinet shall include a minimum of two (2) heads each as documented on the fire sprinkler drawings from Hughes & Associates.

1.13 AS-BUILT DRAWINGS

- A. During the course of the project, the Contractor shall develop electronic versions of the as-built drawings. The Contractor shall be required to show the following on these floor plans for as-built drawings:
 - 1. The exact locations and installation details of all equipment installed including the piping, hangers, sprinklers, valves, etc.
- B. The Contractor shall show the equipment and devices on a separate layer and provide copies of only this layer shown on the floor plans as part of the set of as-built drawings.
- C. During the automatic fire sprinkler system installation, the draft as-built drawing shall be updated every 24 hours. The on-site as-built drawings shall be available for inspection and review on request by the Owner.
- D. Upon completion of the installation of the system and a minimum of one (1) week prior to the Demonstration Test, the Contractor shall deliver two (2) complete sets of reproducible, full-size, appropriately scaled, as-built drawings to the Owner.
- E. The as-built drawings shall be in a final form for submission for final approvals.

1.14 TEST PLAN

- A. Upon completion of the installation of the system and a minimum of one (1) week prior to the Demonstration Test, the Contractor shall deliver two (2) complete sets of the Test Plan, which shall describe how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. All tests shall be conducted in the presence of the Owner and shall not be conducted until the "Test Plan" is approved.
- B. System shall be under warranty to owner for a period of two years. During that period system shall be free of nuisance operation and defective equipment. False alarms due to defective equipment or installation shall be the responsibility of the contractor to repair with out cost to owner.

1.15 OPERATING AND MAINTENANCE MANUAL

- A. The Contractor shall provide three complete indexed bound sets of the Operating and Maintenance (O&M) Manual a minimum of one week prior to the Demonstration Test of the system. These O&M Manuals shall include the following:
 - 1. The final Equipment List identifying the quantities and types of equipment listed by manufacturer's part number.
 - 2. A detailed narrative description of the system ancillary functions, intended sequence of operations, application considerations, and limitations.
 - 3. An equipment datasheet (or specification sheet) on every piece of equipment installed.

4. Operator instructions for basic system operations.
5. A detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed.
 - a. This information shall include manuals that outline inspection, testing and maintenance procedures for all equipment, as well as any other special maintenance procedures for any other pieces of automatic fire sprinkler and standpipe equipment installed in the building.
6. Detailed drawings showing the location of all control valves and the areas served by those control valves.
7. A service directory, including a list of names and telephone numbers of those who provide service for the system.
8. All material shall be given to the General Contractor.

1.16 WARRANTY

- A. The Contractor shall guarantee all new equipment installed from defects in workmanship and inherent mechanical and electrical defects for a period of one (1) years from the date of substantial completion of the project and acceptance by the Owner.
- B. The Manufacturer or the authorized representative shall guarantee all new system equipment for a period of one (1) years from the date of substantial completion of the project and acceptance by the Owner.
- C. Upon completion of the installation of the automatic fire sprinkler / standpipe system equipment, the Contractor shall provide the Owner with a signed written statement, substantially in the form as follows:
 1. "The undersigned, having been engaged as the Contractor on the Silverleaf Resorts, Inc. project, confirms that the automatic fire sprinkler system equipment was installed in accordance with the system manufacturer's installation instructions, and technical specifications provided to us by the manufacturer and the Contractor."
- D. The warranty period shall begin on the date of substantial completion of the project and acceptance in writing by the Owner.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All components shall be used in accordance with the manufacturer's recommendations and its UL listing and/or FM approval.

- B. The naming of manufacturers in the specifications shall not be construed as eliminating the materials, products or services of other manufacturers and suppliers providing approved equivalent items.
- C. The substitutions of materials or products other than those named in the specifications are subject to prior approval by the Owner granted in writing.

2.02 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PIPE

- A. Pipe shall be new, designed for 175 psi working pressure, conforming to ASTM specifications, and have the manufacturer's name and brand along with the applicable ASTM standard marked on each length of pipe.
- B. Steel:
 - 1. Standard Wall:
 - a. Shall be black steel and must comply with the specifications of ASTM A135 and/or A795 for welded and seamless black steel pipe for fire protection use. Dimensions for pipe shall be in accordance with the American Standard for Wrought Steel and Wrought Iron Pipe ANSI B36.10 for pressure up to 300 psi. Schedule 40 pipe is considered "standard wall" pipe. Pipe ends shall be welded, threaded or cut grooved.
 - 2. Pipe passing through fire resistance rated walls, floors, etc., shall be perpendicular to the assembly being penetrated and shall be fire stopped.
 - 3. Fittings:
 - a. Changes of direction, unless otherwise noted, shall be accomplished by the use of fittings suitable for use in sprinkler systems and defined in NFPA 13. Bushings shall not be used unless written approval is obtained from the Owner. Additional fittings, pipe and hangers required by site conditions shall be provided at no additional cost to Owner.
 - b. Screwed fittings shall be cast iron, 125 pound class, black, and in accordance with ANSI B16.4 or malleable iron, 150 pound class, black and in accordance with ANSI B16.3.
 - c. Flanged fittings shall be cast iron, short body, Class 205, black and in accordance with ANSI B16.1. Gaskets shall be full-face of 1/8-inch minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B18.2.
 - d. Welded fittings shall be steel, standard weights, black, and in accordance with ANSI B16.9, ANSI B16.25, ANSI B16.5, ANSI B16.11 and ASTM A234.

- e. Grooved couplings and mechanical fittings shall be malleable iron in accordance with ASTM A47. The couplings' gasket material shall be butyl rubber. Grooved couplings and mechanical fittings shall be tested and UL listed and FM Approved.
 - f. Grooved fittings, valves and pipe shall be joined using rubber gasket couplings produced by the manufacturer of the fitting and/or valves. Gaskets shall be listed for use for the appropriate application. Rigid grooved couplings shall be used where horizontal piping runs require more than two couplings per run.
 - 4. Mechanical grooved joints may be used only on main sprinkler tree within the mechanical rooms. Exception to this will be that grooved connections may be used in concealed space for installation of piping for the fire department connection (FDC) on the building providing the check valve for the FDC is installed within three feet of the sprinkler tree in the Mechanical room. Mechanical grooved joints cannot be installed at any other location within the building either exposed or concealed.
 - 5. The bending of pipe will not be allowed to avoid the installation of fittings.
- C. Steel-Dry Pipe Sprinkler System:
- 1. Standard Wall:
 - a. Overhead pipe used shall be galvanized steel and must comply with the specifications of ASTM A135 and/or A795 for welded and seamless black steel pipe for fire protection use. Dimensions for pipe shall be in accordance with the American Standard for Wrought Steel and Wrought Iron Pipe ANSI B36.10 for pressure up to 300 psi. Schedule 40 pipe is considered "standard wall" pipe. Pipe ends shall be welded, threaded or cut grooved.
 - 2. Pipe passing through fire resistance rated walls, floors, etc., shall be perpendicular to the assembly being penetrated and shall be fire stopped.
 - 3. Fittings:
 - a. All fittings shall be galvanized.
 - b. Changes of direction, unless otherwise noted, shall be accomplished by the use of fittings suitable for use in sprinkler systems and defined in NFPA 13. Bushings shall not be used unless written approval is obtained from the Owner. Additional fittings, pipe and hangers required by site conditions shall be provided at no additional cost to Owner.
 - c. Screwed fittings shall be cast iron, 125 pound class, black, and in accordance with ANSI B16.4 or malleable iron, 150 pound class, black and in accordance with ANSI B16.3.
 - d. Flanged fittings shall be cast iron, short body, Class 205, black and in accordance with ANSI B16.1. Gaskets shall be full-face of 1/8-inch minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B18.2.

- e. Welded fittings shall be steel, standard weights, black, and in accordance with ANSI B16.9, ANSI B16.25, ANSI B16.5, ANSI B16.11 and ASTM A234.
- f. Grooved couplings and mechanical fittings shall be malleable iron in accordance with ASTM A47. The couplings' gasket material shall be butyl rubber. Grooved couplings and mechanical fittings shall be tested and UL listed and FM Approved.
- g. Grooved fittings, valves and pipe shall be joined using rubber gasket couplings produced by the manufacturer of the fitting and/or valves. Gaskets shall be listed for use for the appropriate application. Rigid grooved couplings shall be used where horizontal piping runs require more than two couplings per run.

2.04 JOINING MATERIALS

- A. Refer to Manufacturer's specifications for grooved pipe fittings, pipe-flange gasket materials and welding filler metals.
- B. Joint compound or tape shall be applied to male pipe threads only for all threaded joints.
- C. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.05 SPRINKLERS

- A. Install intermediate and high temperature sprinklers of proper degree rating wherever necessary to meet the requirements of NFPA 13.
- B. Large orifice sprinklers shall have ¾-inch NPT threads.
- C. Listed lead-coated or corrosion-resistant sprinklers shall be installed in all areas exposed to outside atmosphere or to corrosive conditions.
- D. Covers for concealed sprinklers shall be painted by manufacturer.
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.
 - 1. Pendent Mounting: White finish to match ceiling or wall color.
- F. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler and white or red finish. Guards required in mechanical rooms.

2.06 FIRE PROTECTION SERVICE VALVES

- A. General: UL listed and FM approved, with minimum 300 psig non-shock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead flanged ends.
- B. Gate Valves, NPS 2 and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.

- C. Indicating Valves, NPS 2-1/2 and Smaller: UL 1091; ball-type, bronze body with threaded ends; and integral indicating device. Butterfly valves shall not be permitted.
 - 1. Indicator: Visual.
 - 2. Indicator: Electrical 115-V AC, pre-wired, single-circuit, supervisory switch.
- D. Gate Valves, NPS 2-1/2 and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- E. Swing Check Valves, NPS 2 and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
- F. Swing Check Valves, NPS 2-1/2 and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.

2.07 SPECIALTY VALVES

- A. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4, ball check device with threaded ends.
- B. Backflow Prevention Valves: Where required by the AHJ, provide iron body detector check valve, bronze fitted, with trapped bosses, bypass meter, air vent, and cover mounted eye-bolt.
- C. Dry-Pipe Valves:
 - 1. Design: Differential-pressure type, UL 260 compliant.
 - 2. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 3. Air Compressor: 120-V ac, 60 Hz, single phase.

2.08 FIRE DEPARTMENT CONNECTIONS

- A. General: Provide fire department Siamese connections with the number of outlets and types as indicated on the drawings and in accordance with NFPA 13 and 14.
- B. Material: Siamese shall be polished bronze (or brass) connection with breakaway inlet plugs or chains and caps to match.
- C. Clapper Valve: Provide self-closing clapper valve in each inlet.
- D. Mounting Type: Siamese shall be flush-type as indicated on drawings with "AUTOSPKR" in raised cast form on surface of fitting or escutcheon. Provide the escutcheon with a finish to match the body of the Siamese. Each Fire Department Connection shall supply all areas within the building, and shall be clearly and permanently labeled to indicate that the connection serves the entire building.
- E. Hose Threads: Provide threads that are National Standard Fire Hose Threads, unless otherwise directed by the local fire department.
- F. Install fire department connection between 3 and 4 feet above grade level.
- G. Provide a ball drip to allow for complete drainage of the fire department connection piping.

- H. Ball drip shall be installed and arranged to discharge directly to the outside and shall be located at the low point of the fire department connection piping.
- I. Confirm location with owner before installation.
- J. Any check valves required for FDC piping in ceiling shall have an access panel and approval by owner as to location.
- K. All items listed in sub-section 2.08 are subject to change if over ruled or changed by the AHJ. Final FDC connection location will be determined by the AHJ. Approval by the AHJ before installation or location of any items is recommended.

2.09 HOSE CONNECTIONS (IF REQUIRED BY THE AHJ)

- A. Description: UL 668, 175-psig minimum pressure rating, brass, hose valve for connecting fire hose. Include reducer, cap and chain. Hose valve threads according to NFPA 1963 and matching local fire department threads.
 - 1. Valve Operation: Pressure-regulating type
 - 2. Finish: Rough chrome-plated

2.10 ALARM DEVICES

- A. General: Types matching piping and equipment connections.
- B. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250 psig pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- C. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.11 PRESSURE GAUGES

- A. Pressure Gauges: UL 393, 3-1/2- to 4-1/2-inch diameter dial with dial range of 0 to 300 psig.

2.12 FIRE PUMP

- A. Provide a pre-packaged vertical in-line electric-drive fire pump. The fire pump rated head and capacity shall be based on approved hydraulic calculations. The fire pump churn pressure plus the maximum static pressure shall not exceed 175 psi. The fire pump shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head.

- B. Fire pump shall be UL 448 horizontal split case, single stage, double suction, direct connected with automatic air release type rated for 250 psig maximum working pressure.
- C. Fire pump components:
 - 1. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
 - 2. Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.
 - 3. Bearings: Grease lubricated ball bearings, replaceable without opening casing.
 - 4. Shaft: Alloy steel with replaceable bronze shaft sleeve.
 - 5. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230°F maximum continuous operating temperature.
 - 6. Drive: Flexible coupling with coupling guard.
 - 7. Baseplate: Cast iron with integral drain rim.

2.13 ELECTRIC MOTOR

- A. General: Electrical motors, controllers, contactors, and disconnects as specified herein. The fire pump motor shall be UL listed per UL 1004, and shall comply with NFPA 20. Power supply to the pump and jockey pump motors and controllers is from city service. All electrical equipment and installation methods shall comply with NFPA 70, Article 695 and other applicable articles.
- B. Motor shall be squirrel cage induction type, in open drip-proof NEMA MG-1 enclosure.
- C. Motor horsepower and speed shall not be less than the pump requirements for all points on the pump operating curve.
- D. Coordinate power supply requirements and connections with electrical contractor. Power to be three phase, 60 Hz.

2.14 FIRE PUMP CONTROLLER

- A. Electric Motor Controller: Shall be approved for fire pump service and arranged for automatic and manual push-button pump starting and manual push-button pump shutdown. Controller shall be completely terminally wired, ready for field connections, and mounted in moisture resistant ANSI/NEMA 250 enclosure arranged so that controller current carrying parts will not be less than 12 inches above the floor. Controller shall be limited service, across-the-line starting type with a fault current interrupting capacity specified by the manufacturer for the specific model and size controller. Controller power requirements shall be coordinated with electrical contractor. Provide a UL listed power transfer switch

to transfer emergency power to the fire pump; the transfer switch shall transfer power from the emergency generator.

- B. The fire pump controller and transfer switch shall be floor-mounted in the fire pump room.
- C. Fire pump controller system component requirements:
 - 1. Disconnect Switch: Externally operable, quick break type.
 - 2. Circuit Breaker: Trips in each phase calibrated at least to 300% of the motor full-load current, 10,000 amperes interrupting capacity.
 - 3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
 - 4. Pilot Lamp: Indicates circuit breaker closed and power available.
 - 5. Provide ammeter test link and voltmeter test studs.
 - 6. Alarm Relay: Energizes alarm to indicate circuit breaker open or power failure.
 - 7. Provide remote start switch relay.
- D. Manual Selector Station: On enclosure marked "Automatic" and Non-Automatic".

2.15 PRESSURE MAINTENANCE (JOCKEY) PUMP

- A. Provide an electrically-driven type jockey pump with standard open drip-proof enclosure with controller to maintain pressure on the system. Pump shutoff pressure shall not exceed the design working pressure of the system. Provide approved indicating valves in the maintenance pump suction and discharge piping. Jockey pump shall stop when the pressure reaches the fire pump churn pressure plus the maximum static pressure (maximum 175 psi). Pump shall start when the pressure drops to 10 psi below the jockey pump stop pressure.

2.16 JOCKEY PUMP CONTROLLER

- A. Electric Motor Controller: Shall be approved for jockey pump service and arranged for automatic pump starting and automatic and manual shutdown. Controller shall be completely terminally wired, ready for field connections, and mounted in a moisture resistant enclosure arranged so that controller current carrying parts will not be less than 12 inches above the floor. Controller shall be designed for 208 volts and shall be service entrance labeled.

2.17 ALARMS

- A. The fire pump controller shall have auxiliary contacts for monitoring by the fire alarm system. Signals shall be sent to the fire alarm system to indicate a pump running condition, phase loss/AC power failure, phase reversal of line power, and controller connected to alternate power source. Coordinate alarm connections with fire alarm contractor.

2.18 FIRE PUMP TEST HEADER

- A. General: Furnish and install fire pump test header in accordance with NFPA 20. Provide flanged inlet connection to hose valve manifold assembly. Provide approved polished bronze hose gate valve with 2½-inch National Standard male hose threads with cap and chain. Provide polished bronze flush-type with "Test Header" in raised cast form on surface of escutcheon. Locate the assembly 3 feet above grade in the horizontal position for each test header outlet. A ball drip valve shall be installed at the lowest point of the piping and discharge to the outside of the building. Number of outlets shall be in accordance with NFPA 20.

2.19 NAME PLATES

- A. Fire Pumps: Fire pumps shall be supplied with a factory installed nameplate, containing the following information:
1. Manufacturer, type, and model number
 2. Capacity and rated pressure
 3. Churn (no flow) pressure
 4. Pressure at 150% capacity
 5. Date manufactured
- B. Motor: A nameplate, conforming to NFPA 70, shall be provided on the electric motors.

2.20 ACCESSORIES

- A. Provide the following accessories:
1. Eccentric suction reducer and supervised outside screw and yoke gate or butterfly valve on suction side of pump.
 2. Concentric increaser and check valve in pump discharge and supervised outside screw and yoke gate or butterfly valve on system side of check valve.
 3. Fire pump bypass fitted with supervised outside screw and yoke gate or butterfly valves and check valve.
 4. Main relief valve, listed in accordance with UL 1478, and open type waste cone.
 5. Casing ¾ inch relief valve.
 6. Float operated ¾ inch automatic air release valve.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine and verify actual locations of risers, mains and branchline piping before installation.

- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing and other conditions where pipes, risers and cross-mains are to be installed.
- C. All examinations shall be coordinated with the Owner.
- D. All locations shall be approved by the Owner before installation.

3.02 PIPING APPLICATIONS

- A. Do not use welded joints with galvanized steel pipe.
- B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- C. Sprinkler Feed Mains and Risers: Use the following
 - 1. Schedule steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - 2. When indicated on the drawings, standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.

3.03 VALVE APPLICATIONS

- A. The following requirements apply:
 - 1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use gate valves.
 - 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use ball or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.

3.04 JOINT CONSTRUCTION

- A. Refer to manufacturer's specifications for basic piping joint construction.
- B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut-grooved ends or Schedule 30 and smaller steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
- C. Handling of Cleaners, Primers, and Solvent Cements for CPVC Pipe: Comply with procedures in ASTM F402 for safe handling when joining CPVC piping with solvent cements.
- D. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if necessary.

3.05 PIPING INSTALLATION

- A. Refer to manufacturer's specifications and NFPA 13 for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on drawings, as far as practical.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged de-vices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13, as shown on drawings.
- G. Install piping with drains for complete system drainage.
- H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes.
- I. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain.
- J. Install alarm devices in piping systems.
- K. Hangers and Supports: Install according to NFPA 13 for sprinkler piping.
- L. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

3.06 VALVE INSTALLATION

- A. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.
- B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection.
- D. Install valves with stems upright, not horizontal or inverted.

3.07 SPRINKLER INSTALLATION

- A. Install sprinklers in patterns indicated on working drawings.
- B. Install sprinkler pipe concealed within ceiling.

3.08 CONNECTIONS

- A. Connect water-supply piping and sprinklers to City supply.
- B. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- C. Electrical Connections: Power wiring is specified in Division 16.
- D. Connect alarm devices to fire alarm.

3.09 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on valves, equipment and piping according to requirements in NFPA 13.

3.10 FIELD QUALITY CONTROL

- A. Flush entire system, perform hydrostatic test, and inspect piping according to NFPA 13, "System Acceptance." Coordinate hydrostatic test date and time of test with the Owner.
- B. Test sprinkler system for Microbiologically Influenced Corrosion (MIC) with MICKit FPS.
- C. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- D. Report test results promptly and in writing to the Owner and authorities having jurisdiction.

3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

3.12 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

3.13 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete.
- C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.

- E. Fill piping with water.
- F. Verify that MIC test is negative or problem corrected if positive.
- G. Energize circuits to electrical equipment and devices.
- H. Coordinate with fire alarm tests. Operate as required

3.14 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with the Owner with at least seven days advance notice.
- C. Schedule final Acceptance Test with Owner and Authority Having Jurisdiction with at least seven days advance notice.

END OF SECTION

**SECTION 15650
REFRIGERATION**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide a complete packaged, air-cooled condenser-compressor unit with reciprocating or rotary screw type compressors and other components as necessary for a complete and operating system as specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Insulation | Section 15180 |
| D. Heating Generation | Section 15650 |
| E. Fan Coil Units | Section 15700 |
| F. System Testing and Balancing | Section 15850 |
| G. Motors and Circuit Disconnects | Section 16170 |
| H. Controls and Instrumentation | Section 16900 |

1.03 QUALITY ASSURANCE

- A. Manufacturers: Daikin or approved equal.
- B. Ductless split system shall be a Daikin or Mitsubishi (No Others)
- C. Installer: Installer shall have a minimum of five years' experience in the installation of Refrigeration of similar size and scope.
- D. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Mechanical Code with Amendments
 - 3. Local Plumbing Code with Amendments
 - 4. National Electrical Code
 - 5. ASHRAE Standards
 - 6. SMACNA Standards
 - 7. U.L. Listed
 - 8. AMCA Standards
 - 9. A.S.M.E. Standards

1.04 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Architectural Specifications. Indicate construction materials, finishes, sizes, quantities, and related hardware requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during installation shall be rejected.

1.06 COORDINATION

- A. Manufacture shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.
- B. Consult with others trades in advance and make provisions for their work to avoid cutting and patching.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Diakin or approved equal.
- B. Complete with:
 - 1. Hermetic reciprocating or rotary screw compressors.
 - 2. Air cooled condenser with condenser fans.
 - 3. Capacity control system in large units over 5 tons.
 - 4. Refrigerant (410A). Freon [22] not allowed for D/X split systems
 - 5. Compressor and condenser fan starters.
 - 6. Galvanized steel casing.
 - 7. Condenser coil guard.
- C. Compressors:
 - 1. Hermetic reciprocating or rotary screw.
 - 2. Compressor motor suitable for operation in a refrigerant atmosphere
 - 3. Operating oil charge
 - 4. Suction and discharge shut-off valve
 - 5. Factory mounted vibrator isolators
 - 6. Refrigerant muffler
 - 7. Crank case heaters
- D. Condenser:
 - 1. Air cooled
 - 2. Aluminum fins bonded to seamless copper tubes
 - 3. Cleaned, dehydrated, sealed
 - 4. Unit cabinets shall be painted
 - 5. Pressure tested at 450 PSIG
 - 6. Coil guards
 - 7. Condenser fans of the direct drive propeller type with wire safety guards
 - 8. Condenser fan motors to have inherent over-current protection.

9. Provide Blygold coating on condenser coils at sites within 25 miles of coastline. Contact Blygold @ (713) 666-8261. Verification of Condenser coatings must be provided in writing and copy added to warranty book at project completion.
 10. Condensers within 25 miles of coast shall be secured to withstand winds of 140 MPH at a 5 second burst and 110 MPH sustained winds. All means of securing shall be submitted to the Structural Engineer of Record for the project for approval to adherence to TDI requirements.
- E. Refrigerant Components:
1. Hot gas muffler
 2. High pressure shut-off valve
 3. Liquid line shut-off valve
 4. Filter dryer
- F. Controls:
1. Factory furnished and mounted in weatherproof enclosure.
- G. Warranty:
1. A one year parts and labor warranty on all components shall be furnished from date of acceptance by Owner.
 2. Five-minute recycle protection to prevent compressor short cycling.
 3. Lockout on auto-reset safety until reset from thermostat.
 4. High discharge pressure cutout.
 5. Low suction pressure cutout.
 6. All compressors shall have 5 year warranties with replacement cost included in warranty.
- H. Capacity specifications shall be as scheduled on the Drawings.
- I. Unit shall have a minimum SEER of 13.0 at 100% load.

2.02 INCASE DX COOLING COIL

- A. Manufacturers:
1. Trane, Carrier, RUUD, Lennox, YORK, Rheem. (NO OTHERS)
- B. Complete With:
1. Cold rolled steel insulated casing
 2. Aluminum fins bonded to seamless copper tubes
 3. Cleaned, dehydrated, sealed
 4. Pressure tested at 450 PSIG
 5. Thermostatic expansion valve
 6. Insulated internal condensate pan with external drain connection
 7. Auxiliary drain connection or high level shut down switch.
 8. Filter housing factory supplied in unit.
 9. Fan assembly and blower
 10. All electrical components necessary for normal operation
- C. Warranty:
1. One year parts and labor on all components and installation from date of acceptance by Owner.
- D. Capacity shall be as scheduled on the drawings

PART 3 – EXECUTION

3.01 INSTALLATION

A. Air Cooled Condenser-Compressor Unit:

1. Install as detailed on drawings
2. Install in accordance with manufacturer's recommendations.
3. Refrigerant lines leaving the building to outside condensers shall run parallel to each other in a neat manner with distance between lines even. Lines shall run parallel to condensers and be attached to the concrete pad with Unistrut; strut adhered to concrete and proper line clamps designed for lines with insulation. No piping shall touch ground or concrete at any point after they exit the building. All electrical whips used for the purpose of powering the condenser shall conform to the same requirement as the refrigerant lines for installation.
4. All condensers shall conform to minimum requirements as it relates to clearance as shown on drawings or required by code either in clearance from building structure or clearance between each unit. Submit shop drawings with all clearances shown in a plan view format with unit layout shown on drawing.
5. Field fabricated piping above grade in non concealed spaces: Type L annealed copper tubing with silver solder joints. Not allowed on D/X split systems or concealed spaces
6. Field Fabricated Piping Below Grade: Type K soft copper tubing routed in PVC schedule 40 sleeve. No joints will be allowed under asphalt, concrete or walls.
7. No tubing joints solder fittings or connections will be allowed in concealed spaces.
8. Pre-charged piping annealed copper tubing with quick-connect fittings to match connections to equipment. All D/X split systems shall require continuous runs of tubing, no joints once tubing is in walls or any concealed space.
9. Field Fabricated Fittings above ground and in non concealed spaces: wrought copper with silver solder joints.
10. Solder: Silver solder having a minimum melting point of 1050 degrees F.
11. Solenoid Valves: Sporlan solenoid valves with ODF solder connections, type and size to match the service intended.
12. Field fabricated refrigerant lines shall be installed by workmen skilled in the installation and testing of refrigerant piping and refrigerant equipment.
13. All work shall conform to standard engineering practice as recognized by ARI and the American Society of Heating, Refrigerating and Air Conditioning Engineers, and all piping, installation and testing shall conform to the applicable requirements of ANSI B9.2.
14. All refrigerant lines shall be properly pitched and shall have oil traps properly sized, located and installed, complete with properly sized double

suction risers, to ensure that oil in any part of the system will be able to return to the compressor under minimum system operating conditions.

15. Each refrigerant circuit shall have a minimum of one, liquid line dryer and one set of charging valves in a non concealed space with in two feet of condensing unit.
16. Install pre-charged piping with short radius bends as required for a neat and workmanlike installation. When making bends, strip insulation from area of bend and use only a lever type hand bender, which is of the proper size for the tubing being bent. Replace all piping, which collapses or buckles during installation. Replace insulation and secure to piping after piping is in place.
17. All joints on field-fabricated piping shall be brazed using 1050 degrees F silver solder or "Silfos." Valves and accessories shall be protected against excessive temperature during brazing. Keep joints to a minimum.
18. All field-fabricated pipes shall be cut smooth and square with an approved type of pipe cutter. Pipe shall be reamed; cuttings carefully removed and piping thoroughly cleaned of all dirt and oil before soldering.
19. All piping shall be thoroughly tested for leaks by maintaining pressurization during construction and proved tight before charging. Evacuate system to 28.5 "Water Minimum" with oil-submerged vacuum pump and special vacuum hoses. Charge shall be calculated and a volume charging cylinder or electronic scale shall be utilized. Affix a tag to each system showing type of refrigerant.

END OF SECTION

**SECTION 15700
FAN COIL UNITS**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide complete fan coil air handling units with DX cooling, electric heating coil (where specified), filter section, fan section, single point power connection, factory installed disconnect switch and other components as specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Insulation | Section 15180 |
| D. Heating Generation | Section 15650 |
| E. Refrigeration | Section 15650 |
| F. Air Distribution | Section 15800 |
| G. System Testing and Balancing | Section 15850 |
| H. Motors and Circuit Disconnects | Section 16170 |
| I. Controls and Instrumentation | Section 16900 |

1.03 QUALITY ASSURANCE

- A. Manufacturers: Daikin or approved equal.
- B. Installer: Installer shall have a minimum of five years experience in the installation of refrigeration systems of similar size, scope, and quantity
- C. Design Criteria: Catalog numbers are the various manufacturers shown.
- D. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Mechanical Code with Amendments
 - 3. Local Plumbing Code with Amendments
 - 4. National Electrical Code
 - 5. ASHRAE Standards
 - 6. SMACNA Standards
 - 7. U.L. Listed
 - 8. AMCA Standards
 - 9. A.S.M.E. Standards

1.04 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Architectural Specifications. Indicate construction materials, finishes, sizes, quantities, and related hardware requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during installation shall be rejected.

1.06 COORDINATION

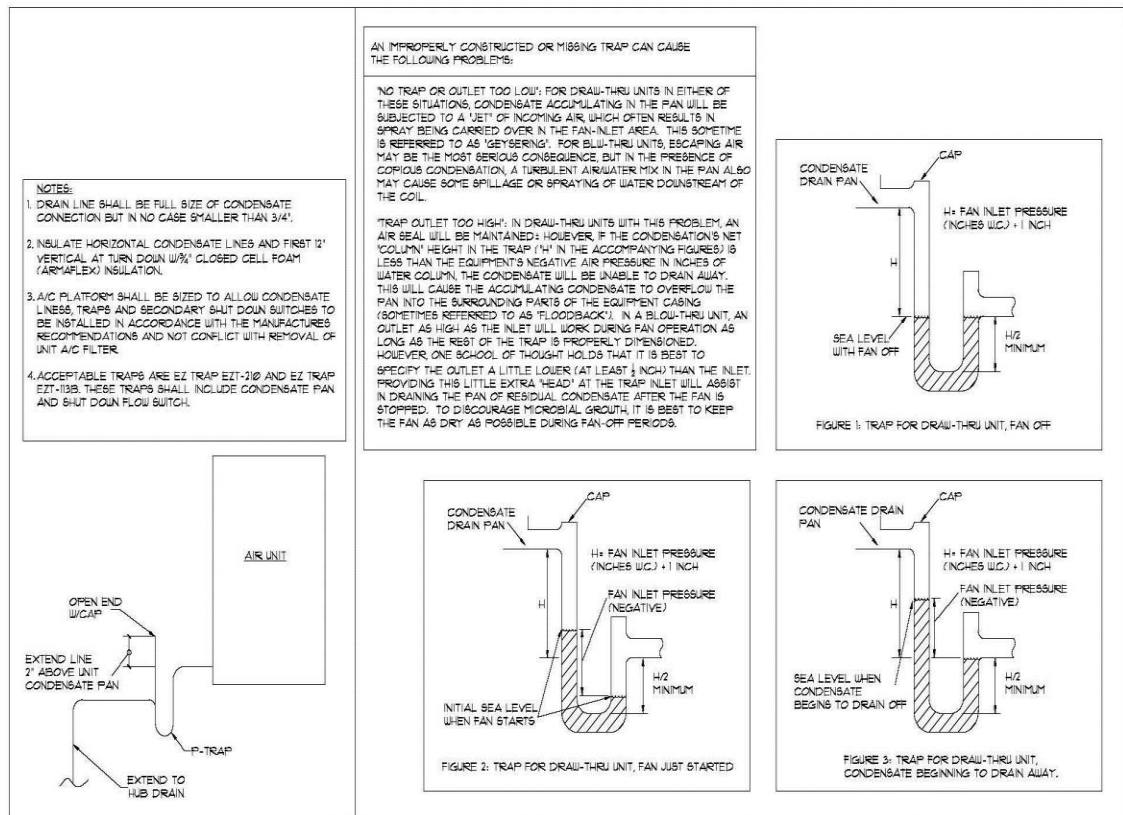
- A. Manufacture shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.

1.07 PRODUCTS

- A. General: Unit shall be factory assembled, single-piece, central-station air-handler. Unit shall consist of a fan and coil section with a factory-installed direct-expansion coil.
- B. Unit Cabinet: Unit panels shall be constructed of milled galvanized steel. Casing panels shall be removable for easy access to the unit. Hinged access door shall be with 1.5 lb. density fiberglass. Insulation for casing panels on unit shall be 1-inch minimum thickness dual-density fiberglass insulation with a density of not less than 1.5 lb. per cubic foot. Insulation shall be secured to casing with waterproof adhesive. Sloped, self-draining condensate drain pans shall have double-wall construction with threaded drain connection, condensate piping shall be schedule 40 PVC with Rectorseal EZ Trap 200 Series for condensate unit trap and clean out.
- C. Fan Section: Fan sections shall be constructed of galvanized steel and have a formed channel base for integral mounting of fan, motor, and casing panels. Fan scroll, wheel, shaft, and bearings shall be rigidly secured to the unit base. Fans shall be double width, double inlet type, with forward-curved blades. Wheels shall be bonderized steel painted with baked enamel, or galvanized steel. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first critical speed, and shall be statically and dynamically balanced as an assembly. Fan shafts shall be solid steel, turned, ground, and polished. Fan bearings shall be self-aligning, selected for an average life of 100,000 hours at design operation conditions; per ANSI/AFBMA Standard 9-1978. Motor shall be NEMA Design B with sizes and electrical characteristics as shown on the equipment schedule. Fan drive shall be designed for a 1.25 service factor and shall be factory mounted and aligned.
- D. Coil Sections: All coils shall have mill galvanized steel casings. Coil performance shall be certified in accordance with ARI Standard 410. Coils shall be provided with pressure-type brass distributors with solder-type connections

and shall have a minimum of 2 distributors. Coils for full-face active or face split operation shall have intertwined circuits for equal loading of each circuit. Suction and discharge connections shall be on the same end.

- E. Condensate drain pan shall have threaded drain connections and shall extend under the complete long coil section of the horizontal, vertical draw-thru units. On single coil horizontal draw-through units with short coil sections, drain pan shall extend under complete fan and coil section. All condensate outlets on fan coil units shall have the outlets on the opposite side of the return air opening for the fan coil unit.
- F. Acceptable condensate traps are EZ Trap EZT-210 and EZ Trap EZT-113b.
- G. No condensate lines or traps are allowed in the return air plenum. No exceptions.



- H. Accessories: Provide the following:
 1. Low-velocity filter sections shall be capable of accepting standard x 1-inch (nominal) filters accessible from either side. Provide low-velocity filter section with hinged access doors on both sides.
 2. Provide auxiliary shut down switch for condensate drain pan
 3. Provide unit with discharge plenum and return air grill accessories.
 4. Platforms for the Air Handler will be purchased through Airflow Design Solutions, at 281-817-5770. Contact Brad Williams.
 5. Discharge duct from air handler shall have a 4" spin in tap prior to leaving Mechanical Room and entering into truss space. Set at 15 cfm. Spin in tap shall be located below access panel to fire damper in leaving duct at ceiling.

6. At the penetration of the main duct leaving the air handler thru the drywall ceiling of the room install an angle shaped sheet metal collar of 18 ga. Minimum attached to the ceiling. It shall encompass the entire duct perimeter. Paint to match ceiling. Allow ½ inch clear between duct insulation and collar. Fill open space with ½" spray foam.
7. Platform for air handler shall be metal on vibration isolators with interior of return metal lined with acoustic liner.
8. Provide fire damper in mechanical duct at ceiling level before duct leaves Mechanical Room to truss space. Provide access panel for fire damper as close to ceiling as possible in leaving air duct from air handler.
9. All return grilles must be aluminum factory baked finish. No field painting.
10. All Mechanical Rooms shall have 4" jump ducts with grilles as indicated on drawings. No jump duct shall terminate in bathroom. If not on drawings please provide and field locate with Silverleaf Project Manager.

END OF SECTION

SECTION 15800
AIR DISTRIBUTION

PART 1 – GENERAL

1.01 SCOPE

- A. Furnish and install all labor, materials, equipment, tools and services and perform all operations required in connection with or properly incidental to the construction of complete Ductwork and Accessories System as indicated on the Drawings, reasonably implied there from or as specified herein unless specifically excluded.
- B. Provide all ductwork, duct devices, dampers, grilles, registers, fire dampers, supports, diffusers, etc., as specified herein, as indicated on the Drawings, by code local and national or as required for a complete system.
- C. All ductwork indicated on the Drawings, specified or required for the air conditioning, heating and ventilating systems shall be of materials as hereinafter specified unless indicated otherwise. All air distribution ductwork shall be fabricated, erected, supported, etc., in accord with all applicable standards of SMACNA Duct Manuals and NFPA 90A and where class of construction equals or exceeds that noted herein.
- D. All ductwork shown on the Drawings, specified or required for the heating, ventilating and air conditioning systems shall be constructed and erected in a first-class workmanlike manner. The work shall be guaranteed for a period of two (2) years from substantial completion of the job against noise, chatter, whistling, or vibration, and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall be corrected with no cost to owner and as directed by Owner and shall include any structural, plumbing, electrical, or architectural requirements.
- E. Submittal of Shop Drawings is required for all ductwork and fittings. All ducts shall be erected in the general locations shown on the Drawings, but must conform to all structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site, and make all necessary changes in cross section, offset, etc., whether they are specifically indicated or not.
- F. Use an approved reflected ceiling plan to coordinate location of air outlets, lights, tile patterns, etc., in preparing sheet metal shop drawings.
- G. All duct sizes shown on plans are internal free area. Requirements for fire dampers in air box discharge, evaporator discharge or return air shall not reduce CFM requirements as listed on drawings.
- H. At no area in the project will flex duct or duct insulation have a rating of less than R-6 in conditioned space or R-8 in non-conditioned space or a length of 5 feet maximum.
- I. The owner shall require the GC to perform and pay for an NEBB Certified Balance for all supply and return registrators as required on the Engineers Drawings. Balance Contractor shall not be from same installing Contractor

installing the original building HVAC. Failure to meet the drawing requirements will result in the contractor correcting all deficiencies as required without cost to owner. Until all corrections are made final draws will be held for HVAC contractor. All cost for any testing to show that drawing requirements for CFM'S and A/C parameters are satisfied shall be at contractor's expense. CFM'S shall mean all supply and return requirements. Report shall also be included in closeout manual. **Report must be submitted before final draw will be paid to General Contractor.**

1.02 RELATED WORK SPECIFIED ELSEWHERE

A.	Supplementary Mechanical Provisions	Section 15010
B.	Basic Materials and Methods	Section 15100
C.	Insulation	Section 15180
D.	Refrigeration	Section 15650
E.	Fan Coils	Section 15700
F.	Air Distribution	Section 15800
G.	System Testing and Balancing	Section 15850
H.	Temperature Controls	Section 15900
I.	Motors and Circuit Disconnects	Section 16170
J.	Controls and Instrumentation	Section 16900

1.03 QUALITY ASSURANCE

- A. Manufacturers: As specified on project drawings.
- B. Installer: Installer shall have a minimum of five years' experience in the installation of air distribution systems of similar size, scope and quantity.
- C. Design Criteria: Catalog numbers are the various manufacturers shown.
- D. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Mechanical Code with Amendments
 - 3. Local Plumbing Code with Amendments
 - 4. National Electrical Code
 - 5. ASHRAE Standards
 - 6. SMACNA Standards
 - 7. U.L. Listed
 - 8. AMCA Standards
 - 9. A.S.M.E. Standards
 - 10. International Energy Conservation Code

1.04 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Architectural Specifications. Indicate construction materials, finishes, sizes, quantities, and related hardware requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during installation shall be rejected.

1.06 COORDINATION

- A. Contractor shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.
- B. Consult with others trades in advance and make provisions for their work to avoid cutting and patching.

PART 2 – PRODUCTS

2.01 POWER ROOF VENTILATORS (Where Applicable):

- A. Manufacturers:
 - 1. Acme
 - 2. Cook
 - 3. Greenheck
 - 4. Penn
 - 5. Approved Equal – Subcontractor to submit all equivalent products for review and approval.
- B. Construction:
 - 1. Heavy gauge aluminum weatherproof housing
 - 2. Non-overloading centrifugal impeller
 - 3. Ventura inlet throat
 - 4. Motor and drive assembly mounted on neoprene vibration isolators
 - 5. Non-fused disconnect switch
 - 6. Drives:
 - a. Adjustable sheaves on belt drive fans.
 - b. SCR control on direct drive fans.
 - 7. Back draft and radiant damper.
 - 8. Bird screen
 - 9. All aluminum construction
- C. Features:
 - 1. Entire drive- assembly and wheel removable without removal of fan from curb.
 - 2. Motor and drive housing completely sealed from exhaust air and fumes.
 - 3. Motors:
 - a. Standard NEMA frame sizes.
 - b. Permanently lubricated bearings
 - 4. AMCA rated for sound and air capacity

5. Motors U.L. approved
 6. Fans wired in accordance with National Electric Code.
- D. Curbs:
1. Prefab galvanized, provided by fan manufacturer.

2.02 DUCT SEALERS

- A. Manufacturer:
1. 3M Co.
 2. United Sheet Metal
 3. Hard Cast
 4. CADS (Fiber Reinforced Water Based Duct Sealant)

2.03 DUCTWORK LOW PRESSURE (LESS THAN 2" SP)

- A. Rigid Ductwork: Where required, all air conditioning and exhaust ductwork, plenum, casings and sheet metal, connections shall be fabricated of new joint-forming quality galvanized prime grade sheets.
- B. Rectangular Low Pressure Ducts: Shall be constructed of the following minimum gauges:

Largest Dimension of Duct	Gauge of Metal
Up to 12"	No. 26 U.S. Gauge
13" to 30"	No. 24 U.S. Gauge
31" to 54"	No. 22 U.S. Gauge

- C. Round Low Pressure Ducts: Shall be "Snap-Lok" or Pittsburg longitudinal seams.
- D. Rectangular Ductwork Fittings: Shall be as manufactured by SMACNA Standards for low pressure ductwork. Slip and drive connections are permitted but must be approved by Engineer on submittal
- E. Round Duct Fittings: Shall be submitted on submittals for the Engineer to approve. Must be an approved SMACNA fitting.
- F. Flexible ducts used in conjunction with low-pressure ductwork shall be supported every 4' of run with proper strapping and saddles so as not to squeeze or crimp duct.
- G. Unless otherwise noted the max length of flex that is permitted will be restricted to five (5) feet.
- H. No fiber duct board allowed or internally insulated duct is allowed except as liner in air return plenum platforms
- I. Flex Duct shall have a metalized jacket, two ply polyester core with encapsulated wire helix. Exterior sheathing shall be reinforced with fiberglass yarn scrim. Will be R-6 or R-8 depending on applications and certified by the ADC. All insulation will be Formaldehyde-Free and Greenguard level 4 microbial resistant.

2.04 DUCT INSULATION

- A. All sheet metal fittings, supply, return and outside air ducts shall be insulated externally with the correct R-value.
- B. Refer to Insulation, Section 15180, for duct insulation requirements.
- C. Air stream [free internal dimensions] is shown on the drawings.

2.05 TURNING VANES

- A. Steel construction
- B. Manufacturers:
 - 1. Cody Company
 - 2. Tuttle & Bailey
 - 3. Sheet Metal Connectors

2.06 DAMPERS

- A. Furnish and install dampers where shown and wherever necessary for complete control of air flow including:
 - 1. Supply branches
 - 2. Return branches
 - 3. Exhaust branches
 - 4. "Division"
 - a. Main supply
 - b. Main return
 - c. Main exhaust
 - 5. Each individual air supply outlet
 - 6. Fresh air ducts
- B. Access Doors:
 - 1. Doors in ductwork only by Mechanical Contractor. Doors in ceilings, walls, chases, etc. by General Contractor. All fire rated doors or panels by Mechanical Contractor.
- C. Volume Control Dampers:
 - 1. Opposed blade interlocking type
 - 2. Adjustable control operator external of duct
 - 3. Axle bearings self-lubricating, ferrule type
 - 4. Manufacturer:
 - a. Price
 - b. Tuttle & Bailey
 - c. Titus
 - d. Hart & Cooley

2.07 FLEXIBLE CONNECTIONS

- A. Install flexible connections between ducts and equipment.
 - 1. Fans
 - 2. Air Handlers
- B. Fabric:

1. Fire resistant
 2. Waterproof
 3. Mildew resistant
 4. Air tight
 5. Weight approximately thirty ounces per square yard.
 6. "Ventglas®" fabric
- C. Where rigid ducts connect to fans, including roof exhausters, flexible connections shall be made using "Vent-glas®" fabric that is fire resistant, waterproof, mildew resistant and practically airtight, and shall weigh approximately thirty ounces (30 oz.) per square yard at least 1/16th inch thick. There shall be a minimum of one-half inch (½") slack in the connections, and a minimum of two and one-half inches (2½") distance between the edges of the ducts except that there shall also be a minimum of one-inch (1") slack for each inch of static pressure on the fan system. These external connections may be omitted on A.C. Units Fans that are factory isolated internally.

2.08 SCREENS

- A. ½" mesh hot dip galvanized hardware cloth screens
1. Set in galvanized steel frames
 2. Attach to opening on exterior side
- B. Provide screen on:
1. Discharge of each roof mounted exhaust fan
 2. Each opening above roof
 3. Inlet of all intake and exhaust louvers and openings
 4. Elsewhere as shown or directed

2.09 GRILLES, REGISTERS, AND OUTLETS

- A. Manufacturer:
1. As noted on plans.
- B. Grilles, Registers and Outlets shall be as scheduled on drawings and shall meet manufacturer's published data for performance criteria.
- C. Velocity of throw in five foot occupancy zone:
1. 50 FPM maximum
 2. 25 FPM minimum
- D. Noise levels not exceed NC35 standards.
- E. Locations shown on Drawings.
- F. All return air systems shall have a minimum ducted size of 150 sq. in. per ton of cooling. There shall be no obstructions in the return air plenums to include studs or water piping.
- G. All evaporators that use a platform of wood or sheet metal for the means of returning air to the evaporator shall be lined with fiber duct board on all vertical and horizontal surfaces. The liner shall face outward to act as a sound diffuser. Liner shall be attached by mechanical fasteners or approved adhesive.
- H. Provide standard manufacturer's accessory items scheduled:

1. Deflecting devices
 2. Manual volume dampers
 3. Provide fire dampers in grille or air registers for ceiling or wall air discharge boxes. This shall include all jump ducts. Air diffusion boxes shall be installed such that the discharge rim of the box protrudes to be flush with the finished area of the drywall ceiling and caulked or as approved by local code, so as to not allow an air gap between drywall and diffuser and box. This shall be done in order to comply with the code and duct leakage requirements.
- I. All ceiling box assemblies shall be insulated to the following specification or equal to Crown No.1565-CRD or 1575-CRD:
1. R-Factor 6.0
 2. 1-1/2" thickness
 3. 1.5 Density
 4. Thermal Conductivity at 75 degrees Mean Temp. .24
 5. UL approved for UL Floor and Truss Assemblies

2.10 FILTERS

- A. Throwaway low velocity type:
1. Average efficiency of 65, ASHRAE test standard 52-68 with test standard.
 2. Average efficiency of not less than 92% free area.
 3. Listed U.L. Class 2
 4. Support grid of minimum 95% free area.
 5. Maximum 300 FPM velocity through filters.
 6. Re-place with new filters prior to final walk thru building with SRI

2.11 FIRESTATS

- A. As required by all Fire or Mechanical Codes.

PART 3 – EXECUTION

3.01 FANS

- A. Install in accordance with details on drawings.
- B. Mount on factory fabricated curbs.
1. Minimum 8"
 2. Weather tight installation to roof
 - a. Flash
 - b. Counter flash
- C. Secure fan to curb:
1. Neoprene gasket between curb and fan
 2. Minimum of eight 3/4" long stainless steel screws.

3.02 DUCTWORK

- A. Construct and erect all ductwork in first class workmanlike manner.
 - 1. Guarantee for two years from date of acceptance against:
 - a. Noise
 - b. Chatter
 - c. Whistling
 - d. Vibration
 - e. Pulsation
 - 2. Correct defects as directed by Owner or Engineer by:
 - a. Removing and replacing
 - b. Reinforcing
 - 3. Sizes shown on plans are clear air stream dimensions.
- B. Duct Erection:
 - 1. General locations shown on drawings
 - 2. Must conform to all building conditions
 - a. Structural
 - b. Finish
 - 3. Contractor shall check physical conditions of job before duct fabrication and make necessary changes:
 - a. Cross-Sections
 - b. Off-Sets
 - c. Obstructions
 - 4. Ducts shall not be supported from wood-deck, but from structural members only with metal strapping.
 - 5. All horizontal ducts shall be supported by means of No. 18 U.S. gauge band hangers attached to the ducts as required and fastened to above structure with screws. Duct shall have at least one pair of supports 4'- 0" on centers.
- C. Construction methods:
 - 1. Construction methods:
 - a. "Low Velocity Duct Manual"
 - b. "Balancing and adjusting"
 - 2. Duct hole for damper rods and other devices
 - a. Drilled
 - b. Machine punched (not pin punched)
 - c. Not any larger then necessary
 - 3. Cross break sheet metal duct panels twelve inches and larger.
 - 4. A minimum of three sheet metal screws shall be used in securing duct connections placed at equal distance around the circumference of the metal duct.
 - 5. Transformation ratios not to exceed one inch of transformation to seven inches of length.
- D. Sheet metal gauge verses size shall conform to the SMACNA Low Velocity Duct Manual for tolerances.

- E. Seal all joints and seams on all sheet metal supply ductwork with hard cast sealer. Duct leakage shall be less than six CFM per one hundred square feet of occupied floor area at no time to exceed 10% of the total CFM at the fan outlet as measured by a duct pressurization test.
- F. A duct pressurization test shall be performed prior to drywall application in the individual units. All duct, flex duct, air register boot, return air pleum, air handler, fire dampers and connection to supply duct work will be installed prior to duct blast leakage test. An NEBB report shall be submitted as to the duct leakage results. The NEBB report and testing shall be administered by firm other than the installing mechanical contractor.
- G. Duct hangers for rigid round and rectangular metal ducts shall be supported from the structure above (not truss) with hangers composed of galvanized steel duct strap or hanger wire with minimum six inch wide saddles and half of the duct circumference. They shall be installed as required to maintain alignment. Horizontal ducts shall have a support within 2ft. of each elbow and within 4ft. of each branch intersection. Upper attachments to structures shall have an allowable load not more than one-fourth of the failure (proof test) load but not limited to the specific methods shown within the SMACNA standard. At no point shall supports be more than eight feet apart. Duct hanging as support shall be per the latest SMACNA 006-2006 Chapter 5.

3.03 DUCT INSULATION

- A. Refer to Insulation, Section 15180, and Paragraph 3.04.

3.04 TURNING VANES

- A. Install in all 90 degree and 45-degree elbow:
 - 1. Supply duct system
 - 2. Where shown on drawings
- B. Must be set at same angle as duct offset.

3.05 DAMPERS

- A. Volume Dampers:
 - 1. Blade Size
 - a. Maximum 48 inch length
 - b. Maximum 12 inch width
 - 2. Blade Construction:
 - a. Minimum 16 gauge steel
 - b. ½" rust-proof axles

3.06 FLEXIBLE CONNECTIONS

- A. Minimum 2½" distance between ducts.

- B. Minimum $\frac{1}{2}$ " slack. Additional 1" slack for each inch of static pressure on fan system.
- C. Excessive vibration and noise created in any part of the building by operation of equipment is not acceptable. Precautions shall be taken against same by the installation of spring or rubber isolators as necessary to eliminate all excessive vibration and objectionable noise produced by any equipment. All equipment having moving parts shall be isolated from the building structure by means of isolators. Manufacturer's recommendations shall be followed in isolation of the equipment. The vibration frequency of the mounted equipment will be less than $\frac{1}{3}$ of the lowest frequency of the equipment during its normal operation.

3.07 ACCESS DOORS

- A. Double skin doors - 1" insulation in door
- B. Ducts larger than 20" in smallest dimension
 - 1. Install doors maximum 20 feet center to center
 - 2. Door 18"x16"
 - 3. As duct size permits
 - 4. Unless otherwise noted
 - 5. Door above non-accessible ceilings. The Contractor shall be responsible for coordination of location of ceiling access doors with owner approval. No access doors will be allowed in living spaces.

3.08 FLASHING

- A. Flash and counter flash:
 - 1. Ducts through roof
 - 2. Ducts through exterior walls
- B. Prevent entry to building:
 - 1. Of rain
 - 2. Of air currents
- C. Minimum 24 gauge galvanized steel.

3.09 TEST OPENINGS

- A. Install in all discharge and return duct as far from units as possible but before first elbow away from unit.

3.10 FILTERS

- A. Filters sections shall be part of air handler [evaporator section] and supplied by the manufacture.
- B. Filters easily removed no lines or objects to restrict.
- C. No operation of air handling equipment without filters.
- D. Replace all filters at no extra cost before any system is started for:
 - 1. Testing

- 2. Adjusting
 - 3. Balancing
- E. Remove and replace all filters with new at final acceptance.

3.11 FIRESTATS (Where Indicated or Required)

- A. Install in all exhaust fan larger than 600 cfm capacity.
- B. Set in fans or units own plenum or inlet connection.
- C. Motors shall stop in case temperature exceeds a predetermined point

3.12 FANS (Where Indicated)

- A. Power Roof Exhausters:
 - 1. Install all fans on factory fabricated and insulated curbs.
 - 2. Securely fasten all fans to the curbs.

END OF SECTION

**SECTION 15850
SYSTEM TESTING AND BALANCING**

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Provide all necessary tools and necessary apparatuses to provide a complete, air system balance of the complete HVAC system.
- B. The balancing, testing, and adjusting of the heating, ventilating, and air conditioning systems will be performed by the HVAC Contractor for the project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Refrigeration | Section 15650 |
| D. Fan Coils | Section 15700 |
| E. Air Distribution | Section 15800 |
| F. Temperature Controls | Section 15900 |

1.03 QUALITY CONTROL

- A. Codes and Standards:
 - 1. Local Building Code with Amendments
 - 2. Local Mechanical Code with Amendments
 - 3. ASHRAE Standards
 - 4. National Environmental Balancing Bureau

PART 2 – WORK TO BE PROVIDED

2.01 WORK BY THE CONTRACTOR

- A. Install all thermostats, controllers, gauges, valves, sensors, control devices and various adjustment devices (dampers, etc.) as indicated and specified on the plans and in these specifications in such a manner as to leave them accessible and readily adjustable.
- B. Supply all data from various suppliers for the balancing work. Such data shall, but is not limited to the following items:
 - 1. Cooling and heating coil data.
 - 2. Filter data
 - 3. Air handling unit, fan coil, condensing unit, diffuser data, etc.
 - 4. Provide additional supplementary data that may be required by the TAB contractor to balance the new HVAC systems.

- C. Review HVAC system and promptly correct any found deficiencies and make any corrections required or deemed necessary to correct any system performance errors.

PART 3 – EXECUTION

3.01 GENERAL

- A. Furnish all necessary apparatuses, coordination, and manpower to accomplish the complete balance of the complete HVAC system as specified.
- B. The owner shall require at the cost of the GC an NEBB Certified balance for all CFM'S required by the Engineers Drawings. May not be administered by mechanical contractor installing HVAC systems. Failure to meet the drawing requirements will result in the contractor correcting all deficiencies as required without cost to owner. Until all corrections are made final draws will be held. All cost associated with the conducting a second NEBB Certification or subsequent reports will be paid by the contractor

END OF SECTION

**SECTION 15900
TEMPERATURE CONTROLS**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide a complete Control System as herein specified for the new Building.
- B. The system shall be complete with necessary thermostats, wiring, etc.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Supplementary Mechanical Provisions | Section 15010 |
| B. Basic Materials and Methods | Section 15100 |
| C. Refrigeration | Section 15650 |
| D. Air Distribution | Section 15800 |
| E. System Testing and Balancing | Section 15850 |
| F. Supplementary Electrical Conditions | Section 16010 |
| G. Control and Instrumentation | Section 16900 |

1.03 QUALITY ASSURANCE

- A. The equipment provided under this section of the Specifications shall be installed; calibrated, adjusted and placed in complete satisfactory operation by HVAC Contractor.

1.04 ACCETABLE MANUFACTURERS

- A. Provide submittals on all thermostats
- B. Honeywell – No Substitutions

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cover and protect materials in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall be rejected.

1.06 COORDINATION

- A. Contractor shall be responsible for details and dimensions not controlled by job conditions and shall show on the shop drawings required field measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain dimensions and job conditions.
- B. Consult with others trades in advance and make provisions for their work to avoid relocation of devices, cutting and patching.

1.07 WARRANTY

- A. Upon acceptance of the building by the owner for its intended purpose, a warranty period of one year commences. The warranty consist of providing at no extra cost to the owner, parts and labor as required to repair or replace parts of the building control system that proves inoperative or faulty due to defective materials, control system design, or installation practices.
- B. Upon completion of the installation, the Contractor shall inspect, check, regulate, and adjust the control system and certify that they are installed in accordance with "record drawings".

PART 2 – PRODUCTS

2.01 THERMOSTATS

- A. Provide Honeywell Lyric T6 Pro WIFI Series Programmable Thermostats. Provide battery with unit and program correct time and day on stat. Set initial temperature at 74 for cooling and 68 for heating.

PART 3 – EXECUTION

3.01 GENERAL

- A. INSTALL THERMOSTATS 48" ABOVE FINISHED FLOOR AND WHERE INDICATED ON DRAWINGS. INSTALL THERMOSTATS PER MANUFACTURE RECOMENDATIONS

END OF SECTION

**SECTION 16010
SUPPLEMENTARY ELECTRICAL PROVISIONS**

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. All Work covered by this section of these specifications will be accomplished in accordance with the respective drawings, Information, or instructions to bidders, general requirements, and the supplementary general conditions of these specifications. Any supplementary conditions, special conditions, addenda, or directives, which may be issued by the Owner, herewith or otherwise, shall be complied with in every respect.
- B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings applicable only to the various separate contracts, sub-contracts, or trades as may be issued for bidding purpose only. The contract documents and the complete scope of work for the project are illustrated on the combined Architectural, Structural, Plumbing, Heating, Ventilating, and Air Conditioning, Electrical Drawings, and Specifications. All drawings and specifications are on file in the Owner's office and each Bidder shall thoroughly acquaint himself with the details of the complete set of drawings and specifications before submitting documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowance will be made because of the unfamiliarity with any portion of the complete set of documents.
- C. Provide complete electrical work where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:
 - 1. Main distribution panel board
 - 2. Building interior and facade lighting.
 - 3. Lighting controls.
 - 4. Motor circuits and controls.
 - 5. Building fire alarm system complete with all electrical connections.
 - 6. Low voltage system raceway.
 - 7. Wiring devices and branch circuit wiring.
 - 8. Other items and services required to complete the systems.
 - 9. Spare LED bulb inventory (one case per bulb type).
- D. It is the responsibility of the General Contractor and his sub-contractors, to furnish a finished product in compliance with all National, State, County and City codes. All codes may not be expressed on project documents or specifications. This does not release the General Contractor or sub-contractor from compliance. Any conflict or duplication of codes by authorities, the stricter code shall rule. There will not be any Change Orders submitted or approved for

compliance with code issues. General Contractor and sub-contractor will to be versed in all codes and adopted amendments. Any code issues not included in bid shall be noted on a qualification sheet at bid time. Any codes issues not qualified are considered to be included in bid.

- E. UNDER NO CIRCUMSTANCES WILL ANY DEVIATION BE ALLOWED TO THE DRAWINGS OR SPECIFICATIONS WITHOUT AN APPROVED RFI. NO EXCEPTIONS.

1.02 SCOPE

- A. The work included under this specification consists of the furnishing of all labor, materials, tools, transportation, services, etc., which are applicable and necessary to complete the installation of the systems specified in the ELECTRICAL SPECIFICATIONS, all as described in these specifications, as illustrated on the accompanying drawings, or as directed by the Owner.
- B. In general, the various lines and ducts to be installed by the various trades under this specification shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards so as to complete the work in a neat, and satisfactorily workable manner. Run work parallel or perpendicular to the lines of the building unless otherwise noted.
- C. The construction details of the building are illustrated on the Architectural and Structural Drawings. Be thoroughly acquainted with the details before submitting a bid, as no allowances will be made because of unfamiliarity with these details. Place all inserts to accommodate the ultimate installation of pipe hangers in the forms before concrete is poured, and masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.

1.03 INSPECTION OF SITE

- A. Visit the site, verify existing items shown on plans or specified, and familiar with the working conditions, hazards, existing grades, actual formations, soil conditions, and the local work conditions and the local requirements involved; submission of bids shall be deemed evidence of such visit. All proposals shall take these existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

1.04 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work have been obtained from city and/or other substantially reliable sources

and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy. Examine the site, verify the locations, elevations and availability of all utilities and services required and be adequately informed as to their relation to the work. The submission of bids shall be deemed evidence thereof.

- B. Verify the location and capacity of existing utility services pertaining to work of Division 16. The location and sizes of electrical lines are shown in accordance with data secured from the civil engineer and electrical engineer.
- C. Provide temporary power in strict accordance with the provisions of these specifications
 - 1. Provide all material required for temporary lighting and power required by building trades to construct a finished product in compliance with drawings. Install in accordance with OSHA, NEC, local and State ordinance or codes.
 - 2. Obtain any permits necessary for temporary power and pay all cost for such.
 - 3. For any electrical heating needs for building construction or completion it will be the requirement of the contractor to furnish. All material and labor required to furnish such to building will be cost of contractor.
 - 4. The Contractor shall furnish all material and labor to connect to existing utilities or as called out on construction documents. Any deviation from scope for connection of building to existing utilities shall be included in proposal as a clarification or qualification to GC'S bid.
 - 5. Contractor will install a meter can and an electrical meter on the temporary power pole from the governing power supplier for power used to construct building. The meter shall be placed in Silverleaf's name. The cost for power used on a monthly basis will be billed to Silverleaf for payment. Cost for first 100' feet of wiring, labor to install and equipment shall be included in Electrical SOV bid for temporary power. Any cost for length longer than 100 feet based on the nearest location to the building or project but not closer than 25' shall require a proposal and approval prior to installing. If a generator is needed for power to the building, project or job trailer then a proposal and approval will be required if no power is available to the site. If the GC or electrical contractor chooses to use a generator instead of temporary power it will be at their expense. If a generator is needed at the time of project or building NTP then a proposal shall be submitted for the cost and must be approved prior to renting generator. This cost will only be incurred until such time as power is made available to site for use as temporary power then all previous requirements will be instituted.

1.05 CODE REQUIREMENTS

- A. All work shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Owner, and shall satisfy applicable local codes, ordinances, or regulations of the governing bodies, and

authorities having jurisdiction over the work or services thereto. In all cases where alterations to, or deviation from the drawings and specifications are required by authority having jurisdiction, upon completion of the work, furnish a statement from the inspecting authority stating that the installation has been accepted and approved. Provide complete utility service connections as directed, and submit as required, all necessary drawings; secure all permits and inspections necessary in connection with work, and pay all legal fees on account thereof. In absence of other applicable local codes acceptable to Owner, the Latest Edition of the National Electrical Code shall apply to this work. The installation including all materials and equipment shall conform to NFPA No. 70-1990; the applicable requirements of the utility companies supplying energy, communications and other services to the project; the laws of the City in which the project sites are located, pertaining to electrical installation; and with all national, state and local codes and laws relating to construction, building and public safety. Each of the above regulations is minimum standards. Where the requirements of these minimum standards are less than or do not conflict with the requirements of the Contract Documents, the Contract Documents shall be followed. Obtain all permits and arrange for all inspections and approvals for the work including construction document review and site observations by the authorities having jurisdiction. Obtain certificates of inspection and acceptance and transmit these to the Owner as a condition of acceptance. Assume and pay all fees and other costs involved in obtaining the permits, inspection, certificates and approvals as a part of Division 16 Work. The requirements and recommendations of the latest edition of the Occupational Safety and Health Act are by reference made a part of these specifications and all electrical work shall comply with their requirements and recommendations wherever applicable.

1.06 MATERIAL AND WORKMANSHIP

- A. All material, unless otherwise specified, shall be new, free from any defects, and of the best quality of their respective kinds. All like materials used shall be of the same manufacture, model, and quality unless otherwise specified.
- B. All manufactured articles, material, and equipment shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned as recommended by manufacturers, or as indicated in their published literature, unless specifically herein specified to the contrary.
- C. All work shall be performed by competent workmen and executed in a neat and workmanlike manner providing a thorough and complete installation. Work shall be properly protected during construction, including the shielding of soft or fragile materials. At completion, the installation shall be thoroughly cleaned and tools, equipment, obstructions, or debris present as a result of this portion of the work shall be removed from the premises. All work shall be done in accordance with the NEC Standard of Workmanship.
- D. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications and all electrical work, unless

otherwise indicated, shall comply with their requirements and recommendations wherever applicable.

1. Institute of Electrical and Electronic Engineers (I.E.E.E.)
 2. American National Standards Institute (A.N.S.I.)
 3. American Society for Testing and Materials (A.S.T.M.)
 4. Electrical Testing Laboratories (E.T.L.)
 5. National Electrical Code. (N.E.C.)
 6. National Fire Protection Association (N.F.P.A.)
 7. Underwriters Laboratories, Inc. (U.L.) United States Only
- E. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Engineer review the change before proceeding with the work. The request for such a change shall be accompanied by shop drawings of the space in question.
- F. This Contractor shall be responsible for the proper location and size of all slots, holes or openings in the building structure pertaining to his work, and for the correct locations of pipe sleeves.

1.07 STORAGE AND PROTECTION

- A. Provide adequate facilities for items furnished under these specifications, which are subject to damage if exposed to elements. Take such precautions as necessary to properly protect apparatus from damage. Failure to comply with this provision will be sufficient cause for the rejection of the particular apparatus involved.

1.08 COOPERATION

- A. All work under these specifications shall be accomplished in conjunction with other trades on this project in a manner, which will allow each trade adequate time at the proper stage of construction to fulfill his work.
- B. Maintaining contact and being familiar with the progress of the general construction and the timely installation of sleeves and inserts, etc, before concrete is placed shall be the responsibility of this trade as well as the installation of the required systems in their several stages, at the proper time to expedite this contract and avoid unnecessary delays in the progress of other work, and meet all requirements of progress schedules set up by the Owner.
- C. Coordinate work with that of other trades to make proper connections at appropriate locations and times. Review the construction of other trades to determine the physical needs and time requirements imposed in providing connections to them as shown on the drawings and in accordance with the project schedule.
- D. The Owner or others may, during the execution of the work, desire to make connections to or modifications of work installed in this Division of Work. Permission from the Owner or others to make these connections or

modifications shall be granted without relieving responsibility for work installed under this Division of Work.

- E. Perform coordination work in strict accordance with provisions of these specifications and the following:
 - 1. Coordinate the installation of electrical items with the Owner for work in finished areas, so as not to interfere with normal daily operations.
- F. Data indicated on the drawings and in these specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the drawings and specifications should be used only for guidance in such regard.
- G. Field verify all measurements. No extra compensation will be allowed because of differences between work shown on the drawings and actual measurements at the site of construction.
- H. The electrical drawings are diagrammatic, but are required to be followed, as closely as actual construction and other work will permit which would affect the appearance or strength of the structure reference shall be made to the Owner for instructions.

1.09 SUBSTITUTIONS OF MATERIALS

- A. In the event substitutions are to be submitted for Owner review, furnish descriptive catalog material, test data, samples, etc., of the specified material and the proposed substitute, as well as any other pertinent data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified products. Rejections of submittals are limited to twice on any one item. A third submittal on any one item needing approval will incur an additional charge from Silverleaf at the rate of \$50.00 p/hr for approval.
- B. Substitutions shall not be made without written acceptance and the lack of acceptance shall not be a basis of change in the work.
- C. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.
- D. Submittals for "equal" items shall, where applicable, include the following data, which are not necessarily required for specified items:
 - 1. Performance characteristics.
 - 2. Materials.
 - 3. Finish.
 - 4. Certification of conformance with specified codes and standards.
- E. Submittals of "equal" components or systems may be rejected if:
 - 1. The material or equipment would necessitate the alteration of any portion of the mechanical, electrical, architectural or structural design.
 - 2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

- F. Proposed substitutions for materials or equipment must be submitted three (3) days prior to final bid for consideration as approved equals. Otherwise, such substitutions will not be permitted. Proposals for substitutions shall be made only by the bidders. Manufacturers, distributors, and sub-contractors shall not make proposals to the Owner for substitutions.
- G. No substitution shall be made unless authorized in writing (RFI) by the Engineer. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, the Contractor shall replace this material or equipment with material or equipment specified, at his own expense, and to the satisfaction of the Owner.
- H. Contractors submitting bids on substitute materials and equipment must also submit a bid on the "as specified" materials and equipment.

1.10 SCHEDULE OF MATERIALS

- A. Reference Architectural Sections of the specifications.
- B. Clearly label by note calling to the Owners attention all items, which are a deviation from the contract documents.

1.11 SHOP DRAWINGS AND SUBMITTALS

- A. Shop drawings and/or catalog data shall be submitted on the following items but shall not be limited to these items. Shop drawings will be submitted in advance of required installation. The submittal or drawings will be submitted within a minimum of three weeks prior to items being required for installation in the project. Failure to meet this time requirement will not be grounds for any time delays being granted to the General Contractor for the project.
 - 1. Main building disconnect & distribution panel (HP1)
 - 2. Branch circuit panel boards.
 - a. Each load center shall be listed by name as indicated on the contract documents, (i.e. standard, accessible, lockout). The total number of each named load center (i.e. standard, accessible, lockout) shall be tabulated and clearly indicated in the submittal. The total contents of each named load center shall be tabulated and clearly indicated in the submittal in the following format.
 STANDARD UNIT-FLOORS 1, 2 3, & 4
 12 Total- load centers per building – 24 circuit panel, 125A MLO
 10KAIC
 8 – 1P/20A – Breakers
 2 – 1P/20A – ARC Fault Breakers
 1 – 1P/20A – GFI Breaker
 2 – 2p/40A – Breakers
 1 - 2P/30A – Breakers
 1 - 2P/15A – Breakers
5 – Blank Spaces

24 – Total Circuit

3. Circuit breakers.
 4. Lighting fixtures and lamps.
 5. Conduit and fittings.
 6. Conductors.
 7. Safety switches.
 8. Dimmers.
 9. Cabinets and enclosures.
 10. Contractors, time clocks and photocells.
 11. Wiring devices and cover plates
 12. Fire alarm system complete with initiating devices, smoke detectors, sprinkler system, and flow and tamper switches and all hook-ups.
 13. Audio/visual enunciators.
 14. Emergency lighting, exit lighting
- B. Submittals of rejected submittals shall be limited to three (3) in numbers. Costs for processing subsequent submittals in excess of the first submittal, resulting from the contractor's disregard or Architect/Engineer's primary submittal rejection comments, shall be based on Architect/Engineer's hourly rates plus a 2.75 mailing, and photocopies at direct cost plus ten percent (10%).
- C. Any deviation from the NBP recommended suppliers which results in the wrong equipment or finishes being installed shall be the responsibility of the Contractor to replace all non-compliant or unspecified items or equipment at no cost to the owner. Should the drawing schedule be incorrect, incomplete or a submittal approved that is incorrect as supplied by a vendor other than the NBP recommended vendor it will be the responsibility of the Contractor to furnish the correct equipment or items and replace without any cost to the owner.

1.12 DRAWINGS AND SPECIFICATIONS

- A. The drawings show diagrammatically the locations of the various conduit, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The system shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building and in cooperation with Contractors and in all cases, shall be subject to the approval of the Architect. The Owner reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.
- B. Should any change be deemed necessary in items shown on contract drawings, the shop drawings, descriptions, etc., the reason for the proposed changes shall be submitted to the Architect for approval.
- C. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before bids are submitted; otherwise the Contractor shall be responsible for the cost of any changes and additions that may be necessary to accommodate his particular apparatus.

- D. Lay out his work maintaining all lines, grades, and dimensions according to these drawings with due consideration for other trades and verify dimensions at the site prior to any fabrication or installation; and should any conflict develop or installation be impractical, the Architect shall be notified before installation or fabrication and the existing conditions shall be investigated and proper changes affected without any additional cost.
- E. Titles of sections and paragraphs in these specifications are not to be construed as a correct or complete segregation of the tabulation of the various units of materials and/or labor requirements. The Owner does not assume responsibility, either direct or implied, for omissions or duplications by the Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.
- F. During the execution of work, maintain a complete set of reproducible drawings upon which all dimensional locations of equipment, deviations and changes in the work shall be recorded. These Record Drawings shall be in good condition and shall be marked "Record Drawings", signed, dated and transmitted with two sets of prints under a transmittal letter to the Owner upon completion and acceptance of the work and before final payment is made.
- G. The following data, as applicable to the work, shall be included in items furnished for use by the Owner:
 - 1. Record Drawings as specified above and elsewhere.
 - 2. Four (4) brochures of Electrical Distribution Equipment with final drawings, operating instructions and maintenance instructions.
 - 3. Four (4) brochures each for protection and alarm systems installed with final installation and connection diagrams; equipment operating, testing and maintenance instructions.
- H. Provide project record documents associated with the work of Division 16 in strict accordance with the provisions of these specifications.
- I. Throughout progress of the Division 16 Work, maintain an accurate record of changes in the contract documents that apply to work of Division 16.
- J. Accuracy of Records:
 - 1. Thoroughly coordinate changes within the record documents, making adequate and proper entries on each page of specifications to each sheet of drawings and other documents where such entry is required to show the change properly.
 - 2. Accuracy of records shall be such that future searches for items shown in the contract documents may rely reasonably on information obtained from the approved project record documents.
- K. Maintain the job set of record documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final project record documents.
- L. Final Project Record Documents:
 - 1. The purpose of the final project record documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site measurement, investigation and examination.

2. Present a clean, neat set of reproducible "as-built" drawings in accordance with the requirements of this paragraph "Project Record Documents".

1.13 ARCHITECT'S APPROVAL

- A. In any statement under this contract where "approval" is required or requested, it is understood that such approval must be obtained from the Owner in writing before proceeding with the proposal, and an adequate number of copies of such proposal shall be submitted to the Architect.
- B. The approval by the Architect of any material, charges, drawings, etc., submitted will be considered as general only and to aid the Contractor in expediting his work. Such approval as may be given does not in any way relieve the Contractor from the necessity of furnishing all materials and performing all work as required by the drawings and specifications.

1.14 LOCAL RESTRICTIONS

- A. Become familiar with rules and regulations of the City, County, and State; or any authority having jurisdiction over this project; and if in his opinion, any work or material shown on the drawings or specified does not comply with these rules and regulations as to size, type, capacity, and quality, make it known prior to the submission of his bid, which shall be deemed evidence of compliance; otherwise, be responsible for the approval of work or material, and in the event that any such authority should indicate disapproval, correct same with material approval by the Architect at no additional cost to the Owner. Obtain all permits, inspections and approvals for the work including construction document review and site observations by the authorities having jurisdiction. Obtain certificates of inspection and acceptance and transmit these to the Architect as a condition of acceptance. All fees and other costs involved in obtaining these permits, inspections and approvals shall be assumed and paid under the Division of the Work.

1.15 ELECTRICAL WIRING

- A. Except for such items as are normally wired up at their point of manufacture and so delivered, unless specifically noted to the contrary herein. The Electrical Contractor shall do electrical wiring of every character for power supply including the control panel shall be by the controls contractor, see Section 15900 of the Mechanical Specification. The Owner or other Contractors will erect all motors in place ready for connections and shall furnish with each such motor starter of the type specified and deliver it in good condition to the Contractor at the job. The Contractor shall mount all such starters as directed, furnishing supporting structures where a starter of the type specified and delivered it in good condition to the electrician-in-charge at the job. The Electrical contractor shall mount such starters as directed, furnishing supporting

structure where necessary. The Contractors will furnish with each item requiring electrical connections, the necessary instructions and wiring diagrams to the Contractor. Refer to the Mechanical Specifications to determine the scope of other work.

1.16 RESPONSIBILITY

- A. The Contractor will be held responsible for the satisfactory and complete execution of all work specified or indicated. He shall produce a completely finished operating system and provide incidental items required as part of his work, regardless of whether such items are particularly specified or indicated.

1.17 HANGERS AND INSERTS

- A. All hangers, brackets, clamps, etc., shall be of standard weight steel. Perforated straphangers shall not be used in any work. When two (2) or more conduits are run parallel, they may be supported on trapeze hangers equal to Modern Co. Other hangers shall be constructed with rods and hanger adjusters of adequate size to carry the loads imposed.
- B. Unless otherwise shown on the Drawings, all horizontal runs conduit and piping shall be suspended from the floor or roof construction, as the case may be, by means of approved hangers for piping. 1¼" in size and smaller shall not be spaced more than nine feet (9') on centers. Vertical risers shall be supported by approved riser clamps or supports installed at the respective floor lines.
- C. Supports and hangers shall be installed to permit free expansion and contraction in the raceway systems. Where necessary to control expansion and contraction, the raceways shall be guided and firmly anchored; anchors shall be approved by the Owner and shall be designed for equal effectiveness for both longitudinal and transverse thrust. No conduit shall be self-supported nor shall it be supported from equipment connections. Transmissions of vibration, noise, etc, shall be considered and any special suspension with vibration dampers to minimize transmission shall be used where necessary.
- D. Where conduits interfere with the proper location of hangers, furnish and install trapeze hangers. Trapeze hangers may be used to support groups of conduits run parallel.
- E. Coordinate field priming of exposed hangers and supports before installation. Refer to Section 09900.

1.18 EXCAVATION AND BACKFILLING

- A. Contractors shall do all necessary excavating and backfilling for the installation of his work. Trenches for underground piping and conduits shall be excavated to required depths with bell holes provided as necessary to insure uniform bearing. Care shall be taken not to excavate below depth, and any excavation below depth shall be refilled with sand or gravel firmly compacted. Where rock or hard objects are encountered, they shall be excavated to grade six inches

(6') below the lowermost part of the conduit and refilled to grade specified. After the conduits have been installed, approved, and the trenches backfilled to grade, any disturbed or cut conduit damaged by any other work will be the expense of the Contractor.

- B. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. All shoring required to protect the excavation and safeguard employees shall be properly performed.
- C. Exterior conduits shall be installed with a minimum of 24 inches of cover below the finished grade, unless otherwise indicated or required by local ordinances. All exterior conduits shall be installed with a minimum of 12" of cover below the finished paving grade, unless otherwise indicated or required by local ordinances.
- D. Backfilling shall be made with selected soil, free from rocks and debris and shall be pneumatically tamped with 6-inch layers to secure a field density ratio of 90 percent as defined by ASTM Designation D698-58T (Proctor Soil Compaction Test).
- E. Excavated materials not suitable and not used in the backfill shall be removed from the site.
- F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, they shall be repaired at no cost to Owner.
- G. In a lime-stabilized area, the lime stabilization shall be fully restored after the excavation is complete.
- H. Replace concrete, curbs, paving and other surface improvements cut during excavation to their original condition.
- I. Replace all landscaping disturbed during excavation. Renew to condition that existed before excavation.

1.19 SLEEVES AND ESCUTCHEONS

- A. Generally, where pipes padding through walls or floors, 22 gauge galvanized sheet iron sleeves shall be used, except those in beams, outside walls, structural members in which shall be standard galvanized steel pipe. The size of these sleeves shall be as to permit readily the subsequent insertion of pipe of conduits of the proper size with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, the inside diameter of the galvanized iron pipe sleeves shall be at least ½" greater than the outside diameter of the service pipe. After the conduits are installed, fill the annular space between the conduits and its sleeve with mastic or caulk with lead. Use packing as required to accomplish this.
- B. Escutcheons, except as specifically noted or specified, shall be installed on all conduits passing exposed through the floors, walls, or ceilings. Escutcheons shall be equal to the Crane No. 10, chrome plated sectional floor and ceiling plates, and shall fit snugly and around conduits. Solid chrome plates with set screws shall be used if sectional plates do not fit properly or stay in place.

- C. Furnish and install flashings where conduits pass through outside walls. Flashings shall be properly formed to fit around conduit and shall be caulked, with 790 Silicone Building Sealant by Dow Corning Corporation, so as to make a watertight seal between conduit and building.
- D. Unless otherwise specified, install sleeves for each conduit where it may pass through interior walls or floors. Galvanized 22-gauge sheet iron sleeves shall be used. Finish flush with each finished wall surface. In pipe chases, they shall extend 1-1/2" above the floor slab and be watertight cemented. The sized of sleeves shall be such as to readily permit the subsequent insertion of the proper size conduits of raceways.
- E. The conduits and raceways that pass through concrete beams or walls and masonry exterior walls shall be provided with galvanized wrought iron pipe sleeves. The inside diameter of these sleeves shall be at least 1 inch greater than the outside diameters of the service pipes. After the pipes are installed in these sleeves, fill the annular space between pipes and sleeves with 790 Silicone Building Sealant by Dow Corning Corporation. The completed installation shall be watertight.
- F. Penetration through walls floors and ceilings shall be done in such a manner to maintain the integrity of the fire rating of the respective wall, floor or ceiling. All light fixtures installed in such a manner to cause the one hour ceiling to be penetrated shall extend into the penetration by a minimum of 1/4" in order to not allow any air gaps between the drywall and fixture.

1.20 PAINTING

- A. Refer to Architectural Specifications for painting.
- B. Electrical equipment, panel board fronts, etc. shall be delivered to the job with suitable factory finish. Finish marred in transit or during installation shall be refinished under this Division of Work to present a neat, workmanlike appearance equal to the factory finish.
- C. Except as elsewhere required, painting of equipment, boxes, conduit, etc., furnished under this Contract will be performed under another division of work. Clean electrical work of all trash, dirt, marks, and other foreign materials under this Division of Work prior to the application of finishes.

1.21 TEST AND LOAD BALANCING

- A. Test all circuits to assure them to be free of ground. Prove and test energy available at the load side of disconnect switches and the final point of connection to driven equipment. Make all reasonable tests as required by the Owner to prove the integrity of work and leave the complete electrical installation in first class condition and ready for operation.
- B. Balance the load on each phase when connecting the various branch circuits and in each panel board. When all load is turned on and the system is in operation at 100% demand, the initial unbalance shall not exceed 10%.

- C. Furnish at the completion of the job, a final inspection certificate from the local inspecting authority.

1.22 GUARANTEE

- A. The entire system shall be guaranteed to be complete and installed in accordance with these plans and specifications.
- B. Replace, during the period of the guarantee, any parts found to be defective in their operation, without cost to the Owner.
- C. Incandescent lamps shall be excluded from requirements of this guarantee, but all electric discharge compact fluorescent, and quartz lamps shall be covered under the guarantee.
- D. The warranty shall be for a period of one year after Certificate of Occupancy for beneficial use by the Owner unless otherwise indicated elsewhere. Wiring shall be warranted for a period (2) two years from Certificate of Occupancy.

1.23 OPERATION AND MAINTENANCE DATA

- A. The following shall be included in the GC'S manual presented to the owner
 - 1. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and reassembly.
 - 2. Complete nomenclature of all parts of all equipment.
 - 3. Complete nomenclature and part number of all replaceable parts name and address of nearest vendor and all other data pertinent to procurement procedures.
 - 4. Copy of all guarantees and warranties issued.
 - 5. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
 - 6. Such other data as required pertinent to specifications.

1.24 EQUIPMENT FOUNDATIONS

- A. Provide equipment foundations associated with the work of Division 16 in accordance with the provisions of these specifications.
- B. Provide concrete bases for new pad mounted primary transformer and electrical switchgear interior. Bases shall be four inches (4") thick and 4" above finished floors or grades (unless otherwise noted) and shall protrude two inches (6") beyond all sides of equipment and shall have exposed chamfered edges. Exterior bases shall be concrete Minimum of 8" thick or same depth of building slab with the same 6" clear on at least three sides. Construct bases from ready-mixed hard rock concrete, ASTM C94, reinforced with #3 rebar's, ASTM A615, Grade 40, at 18" on center each way.
- C. Field verify exact location of outdoor pad mounted electrical equipment with the owner.

1.25 CUTTING AND PATCHING

- A. Do all cutting necessary for the installation of Division 16 Work. Cutting shall be carefully and neatly done so as not to damage or cut away more than necessary.
- B. Where Division 16 workmen damage or cut away work excessively, patching will be performed as a part of Division 16 Work. Patching will be by craftsman experienced in performing this type of work.
- C. Perform cutting and patching associated with the work in strict accordance with the provisions of these specifications and the following:
 - 1. Coordinate work to minimize cutting and patching of work.
 - 2. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.
 - 3. Perform cutting and demolition by methods, which will prevent damage to other portions of the work and provide proper surfaces to receive installation of repair and new work.
 - 4. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

1.26 NAMEPLATES

- A. Install nameplates which give contract drawing identification and electric service characteristics on equipment unless specifically indicated otherwise including disconnect switches, panel boards, and main control cabinets for alarm systems. Typed directories shall be provided for panel boards.
- B. In each case where compartments, equipment, etc., are required to be "labeled" or "identified", it shall be construed that nameplates are to be installed.

END OF SECTION

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SECTION 16112 SURFACE RACEWAYS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. All other Sections of Division 16.
- B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for all requirements, including but not limited to the following:
 - 1. Section 16110 – General Requirements for Electrical Work.
 - 2. Section 16141 – Wiring Devices

1.03 SCOPE

- A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of a completed surface raceway system as indicated on the drawings and/or as specified.
- B. Work included:
 - 1. Surface Metal Raceways.
 - 2. Auxiliary Gutters (Wireways).

1.04 QUALITY ASSURANCE

- A. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide only materials that are new, of the type and quality specified. Where Underwriter's Laboratories, Inc. has established standards for such materials, provide only materials bearing the UL label.

2.02 SURFACE METAL RACEWAY

- A. Surface Metal Raceway; Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

- B. Size: As shown on Drawing 1.
- C. Finish: Gray enamel.
- D. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
- E. Boxes and Extension Rings: Designed for use with raceway systems.

2.03 AUXILLIARY GUTTERS

- A. Auxiliary Gutters: General purpose or Rain-tight wireway, with knockouts.
- B. Size: As indicated on drawings.
- C. Cover: Hinged screw applied cover with full gasketing.
- D. Fittings: Lay-in type with removable top, bottom, and side; captive screws and drip shield.
- E. Finish: Rust inhibiting primer coat with gray enamel finish.

PART 3 – EXECUTION

3.01 INSTALLATION – SURFACE METAL RACEWAY ASSEMBLY

- A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
- B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- C. Maintain grounding continuity between raceway components to provide a continuous grounding path.
- D. Fastener Option: Use clips and straps suitable for the purpose.

3.02 INSTALLATION – AUXILIARY GUTTER

- A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure. Install level.
- B. Mount rain tight gutter in horizontal position only.

END OF SECTION

**SECTION 16120
WIRE AND CABLE**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide a system of wires and cables for electrical power, signaling and control.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Control and Instrumentation | Section 15900 |
| B. Supplementary Electrical Provisions | Section 16010 |
| C. Conduits | Section 16111 |
| D. Wire Connection and Devices | Section 16121 |
| E. Controls and Instrumentation | Section 16900 |

1.03 QUALITY ASSURANCE

- A. Source Quality Control Test to meet applicable Underwriters Laboratories, Inc. Standard
- B. Reference Standards:
 - 1. Underwriters Laboratories No. 44 – Rubber Insulated Wires and Cables.
 - 2. Underwriters Laboratories No. 83 – Thermoplastic Insulated Wires and cables
 - 3. Underwriters Laboratories No. 493 – Thermoplastic Insulated Underground Feeder and Branch Circuit Cables.
 - 4. National Electrical Code Latest Edition.
 - 5. All data cabling must meet UNLV TIA Standards, which are available online.

1.04 SUBMITTALS

- A. Samples: Provide samples upon specific request.
- B. Produce Data: If materials are by manufacturers other than those specified, submit product data giving complete description for sizes employed, material type, and electrical ratings.
- C. Certificates:
 - 1. Labels of Underwriters' Laboratories, Inc. affixed to each item of material
 - 2. If materials are by manufacturers other than those specified, submit Certification that material meets applicable Underwriters' Laboratories, Inc., Standards.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables to project in full cartons or reels marked with conductor size, insulation type, and Underwriters' Laboratories, Inc. label.

- B. Store wires and cables in a manner to prevent damage from the elements, personnel, equipment, and moisture.
- C. Handle wires and cables in a manner to prevent damage to conductor, insulation, and identifying markings.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Wires and Cables:
 - 1. South Wire Corporation
 - 2. Cerro Wire Company
 - 3. General Cable Corporation
 - 4. Present manufacture to Architect / Owner for Approval

2.02 MATERIALS

- A. Type THHN/THWN: 600V, thermoplastic insulated, 90 Deg. C copper.
- B. Type XHHW: 600V, cross like Polyethylene insulated 90 Deg. C. copper.
- C. Aluminum Substitutions of Equal Capacity – Electrical Contractor responsible for all equivalent calculations.
- D. CAT-6A Plenum – Solid Copper Network Cable - Blue

2.03 FABRICATION

- A. Copper: Soft drawn annealed, conductivity of 98% pure copper wire. Under no circumstances will Aluminum wiring be allowed anywhere on the project without prior approval by Owner in the form of an official RFI. No verbal or e-mail confirmations will be allowed. Any installation of Aluminum wire without approval by RFI will be removed by the contractor at no expense to the owner. All cost to purchase and install correct copper wiring will be at no cost to Owner. Any delay of project to correct this wiring issue will not be granted to the General Contractor by issuance of delay days. ANY ALUMINUM WIRING SCHEDULE ON THE DRAWINGS IS EXPRESSED FOR USE BY ELECTRICAL CONTRACTOR WHEN USE IS APPROVED BY AN OWNER APPROVED RFI. NO EXCEPTIONS
- B. Conductors: No. 10 AWG and Smaller – Solid. No. 8 AWG and larger – Stranded.
- C. Insulation: Factory color-coded by pigmentation where available.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Examine the system in which the wire is to be installed for defects in equipment and installation, which may cause damage to the wire.
- B. Do not start work until defects have been corrected and until permission is obtained from the Owner's representative.
- C. Install wire in system designated:
 - 1. Use pulling compound where necessary.
 - 2. Do not exceed manufactures recommended pulling force.
 - 3. Do not bend wire less than the manufacturer's recommended minimum bending radius.
- D. Install Wire Types:
 - 1. TW, THW, THHN/THWN, XHHW for light and power branch circuits and control wiring.
 - 2. TW, THW, THHN/THWN, XHHW for feeders, sub-feeders, motor circuits and high ambient temperature locations.
 - 3. Insulation types suitable for the temperature, moisture and elements to which exposed.
- E. Consistently color code wiring continuous throughout the work:
 - 1. 120/208 Volt Systems:
 - a. Phase A – Black
 - b. Phase B – Red
 - c. Phase C – Blue
 - d. Neutral – White
 - e. Ground - Green
 - 2. 277/480 Volts Systems:
 - a. Phase A – Brown
 - b. Phase B – Orange
 - c. Phase C – Yellow
 - d. Neutral – Gray
 - e. Ground - Green
 - 3. Switch legs, travelers, and special systems continuous throughout the work as selected by the Contractor.
 - 4. Where factory colors are not available, code ends of conductors with 1½" colored tape.
- F. Circuits of multiple phases passing through enclosures shall have phases grouped to reduce the reactance effect.
- G. Minimum Sizes:
 - 1. Use no wiring smaller than 12 AWG
 - 2. All circuits shall be sized to limit voltage drop per NEC Code.
 - 3. Control Wiring: No. 20 AWG, unless otherwise specified.

3.02 FIELD QUALITY CONTROL

- A. Field Test Prior to Energizing: Test all wiring insulation levels with ohm meter:
 - 1. Phase to Phase
 - 2. Phase to Neutral
 - 3. Phase to Ground

- B. Perform tests according to manufacturer's recommendations.
- C. Test results shall be in accordance with manufacturer's recommendations.
- D. Correct defect revealed by above tests.

3.03 INSTALLATION

- A. Run feeders and mains continuously without splice from line to load terminals.
- B. Neatly train, control and circuit wiring in cabinets, panels, pull boxes, wire ways, and junction boxes and tie with T & B Ty-Rap nylon cable ties. Clamp or fasten control or circuit cabling in cabinets or other equipment with non-metallic nylon T & T Ty-Rap cable clamps and mounting brackets.
- C. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 20 AWG for control wiring.
- D. Place an equal number of conductors for each phase of a circuit in same raceway or cable.
- E. Splice only in junction or outlet boxes.
- F. Neatly train and lace wiring inside boxes, equipment, and panel boards.
- G. Make conductor lengths for parallel circuits equal.
- H. Pull all conductors into a raceway at the same time.
- I. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- J. Completely and thoroughly swab raceway system before installing conductors.
- K. Provide protection for exposed cables where subject to damage.
- L. Plenum rated cable above ceilings shall be routed in neat and workmanship manner, bundle cables together with cable ties and route parallel to building walls and structure. Support bundles from walls or structure, not from equipment.
- M. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips or metal cable ties to support cables from structure. Include bridle rings or drive rings.
- N. Use suitable cable fittings and connectors.
- O. Connections of conductors to terminals shall be made by pressure connections. Solder joints will be permitted only for low voltage controls. Joints and splices shall be made with clamp type solder less connectors and insulated with friction tape and Scotch No. 33 plastic tape. Spring connectors may be used for splicing No. 8 AWG or smaller conductors.
- P. Splice only in accessible junction boxes.
- Q. Use solder less pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller.
- R. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- S. Thoroughly clean wires before installing lugs and connectors.
- T. Make splices, tape and terminations to carry fully capacity of conductors without perceptible temperature rise.

- U. Terminate spare conductors with electrical tape. Field inspection and testing will be performed under applicable provisions of Division 1 and Division 16.
- V. Inspect wire and cable for physical damage and proper connection.
- W. Torque test conductor connections and terminations to manufacturer's recommended values.

END OF SECTION

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**SECTION 16121
WIRE CONNECTIONS AND DEVICES**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide wire connections and devices to be readily identifiable, mechanically and electrically secure wiring system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Supplementary Electrical Provisions Section 16010
- C. Wires and Cables Section 16120

1.03 QUALITY ASSURANCE

- A. Source Quality Control Test to meet applicable Underwriters Laboratories, Inc. Standard
- B. Reference Standards:
 - 1. Underwriters Laboratories No. 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 - 2. Underwriters Laboratories No. 510 – Insulating Tape.
 - 3. National Electrical Code Latest Edition.
- C. Job Conditions: Connections shall be made in atmospheres that are free from dirt, moisture, and elements, which may be damaging.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Listed with materials.

2.02 MATERIALS

- A. Spring Connectors: Ideal “Wingnut”, 3M-Scotch, Buchanan, and Thomas and Betts.
- B. Terminal Connectors: O-Z/Gedney type XLH, Burndy, and Thomas and Betts
- C. Splice Connectors: O-Z/Gedney type XW with Type XWL cover, Burndy.
- D. “T” and Parallel Connectors: O-Z/Gedney type XTP with Type XTPC cover, Burndy.
- E. Vinyl Plastic Tape: 3M-Scotch #33 or #88, Plymouth and Okonite.
- F. Rubber Tape: Okonite Series 602-10, 3M-Scotch and Plymouth.
- G. Colored Tape: 3M-Scotch 181, Plymouth.
- H. Wire Ties: Thomas and Betts “Ty-Rap”, Ideal, and Panduit.

- I. Tie Mounts, Plates, Anchors: Thomas and Betts, Ideal, and Panduit.
- J. Wire Tags: Self-laminating, cloth, wrap-on type by Thomas and Belts, Ideal, and Brandy.
- K. Terminal Strips: Nylon; 600 volt, modulate plug-on construction; tubular compression slip-in terminals properly sized; complete with mounting track, end clips and anchors by Allen-Bradley, Square D, and Buchanan
- L. Cable and Cord fittings: Crouse-Hinds "CGB" with wire mesh grip, Appleton.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine wires to be joined, tapped, spliced, terminated, and their connecting devices for defects, which may affect the mechanical and electrical integrity of the connection.
- B. Do not proceed until defects are corrected.

3.02 PREPARATION

- A. Remove proper amount of insulation necessary for connection; clean conductors.

3.03 INSTALLATION

- A. No. 10 Wire and Smaller; Connect with spring connectors, terminate at terminal strips.
- B. No. 8 Wire and Smaller; Connect with spring connect and terminate with above specified tape half-lapped to produce a dielectric value equal to wire insulation.
- C. Train, hold, clamp, and tag wiring in cabinets, pull boxes, panel, and junction boxes with above specified devices.
- D. Splices in feeders and mains may be made where designated on the drawings and where prior approval is obtained from the Owner's Representative.
- E. Install cable and cord grips on all cables and cords, entering enclosures. Use wire mesh grips where necessary for strain relief.
- F. Solder connections permitted for low voltage control circuits only. Clean conductors, make mechanically tight by "Western Union" or "Pig-Tail" splice, solder, insulate with half-lapped rubber and vinyl plastic tape to produce a dielectric value equal to wire insulation.
- G. Run feeders and mains continuously without splice from line to load terminals.
- H. Neatly train, control and circuit wiring in cabinets, panels, pull boxes, wire ways, and junction boxes and tie with T & B Ty-Rap nylon cable ties. Clamp or fasten control or circuit cabling in cabinets or other equipment with non-metallic nylon T & T Ty-Rap cable clamps and mounting brackets.
- I. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 20 AWG for control wiring.

- J. Unless indicated otherwise on the contract drawings, use 10 AWG conductors for 20 ampere, 120 volt branch ampere, 277 volt branch circuit home runs longer than 200 feet
- K. Place an equal number of conductors for each phase of a circuit in same raceway or cable.
- L. Splice only in junction or outlet boxes.
- M. Neatly train and lace wiring inside boxes, equipment, and panel boards.
- N. Make conductor lengths for parallel circuits equal.
- O. Pull all conductors into a raceway at the same time.
- P. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- Q. Completely and thoroughly swab raceway system before installing conductors.
- R. Provide protection for exposed cables where subject to damage.
- S. Plenum rated cable above ceilings shall be routed in neat and workmanship manner, bundle cables together with cable ties and route parallel to building walls and structure. Support bundles from walls or structure, not from equipment.
- T. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips or metal cable ties to support cables from structure. Include bridle rings or drive rings.
- U. Use suitable cable fittings and connectors.
- V. Connections of conductors to terminals shall be made by pressure connections. Solder joints will be permitted only for low voltage controls. Joints and splices shall be made with clamp type solder less connectors and insulated with rubber and friction tape or Scotch No. 33 plastic tape. Spring connectors may be used for splicing No. 8 AWG or smaller conductors.
- W. Splice only in accessible junction boxes.
- X. Use solder less pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller.
- Y. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- Z. Thoroughly clean wires before installing lugs and connectors.
- AA. Make splices, tape and terminations to carry fully capacity of conductors without perceptible temperature rise.
- BB. Terminate spare conductors with electrical tape.
- CC. Field inspection and testing will be performed under applicable provisions of Division 1 and Division 16.
- DD. Inspect wire and cable for physical damage and proper connection.
- EE. Torque test conductor connections and terminations to manufacturer's recommended values.

3.04 FIELD QUALITY CONTROL

- A. Tests: Connections shall be resistance tested with megohmmeter as specified for wire.

3.05 ADJUSTMENTS

- A. Assure that wire connectors made by other in equipment furnished by others are mechanically and electrically and electrically sound prior to energizing circuits and system components.

END OF SECTION

**SECTION 16131
JUNCTION AND PULL BOXES**

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Furnish and install junction and pull boxes where indicated or where necessary for installation of the wiring systems.

1.02 REFERENCE DOCUMENTS

- A. The Special Provisions for Electrical Work are hereby made a part of this Section of the Work. Refer to Section 16010.

1.03 SUBMITTALS

- A. Shop Drawings shall be submitted on each specifically fabricated junction or pull box.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Junction and pull boxes shall be flush or surface type as indicated on the drawings or as required to fit into the building construction. Junction and pull boxes shall have screw covers. Small junction boxes, 100 cubic inches and smaller, for control or branch circuit wiring, shall be as specified for outlet boxes and with blank covers.
- B. Junction and pull boxes installed in walls and ceiling spaces shall be code-gauge galvanized steel with galvanized steel covers.
- C. Junction and pull boxes installed outdoors shall be weatherproof with watertight gasket covers fastened with corrosion resistant screws.
- D. Plastic boxes may be used with Romex where allowed by code.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install junction and pull boxes in a neat workmanlike manner and support in accord with the provisions set forth. (2 nails).
- B. Arrange for raceways to enter boxes only in places specifically planned for raceways in the sizing and construction of the cabinets.
- C. Provide auxiliary conductor supports in large boxes where conductors must be supported in boxes and cabinets.
- D. 15" A.F.F. mounting height unless noted otherwise on unit plans.

- E. Do not notch backsplashes.

END OF SECTION

**SECTION 16133
CABINETS**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide cabinets for installation of wiring and equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Painting
- C. Supplementary Electrical Provisions Section 16010
- D. Panel boards Section 16160
- E. Motor and Circuits Disconnects Section 16170
- F. Fire Alarm System Section 16720
- G. Telephone and Raceway System Section 16740
- H. Controls and Instrumentation Section 16900

1.03 QUALITY ASSURANCE

- A. Source Quality Control Test to meet applicable Underwriters Laboratories, Inc. Standard
- B. Reference Standards:
 - 1. Underwriters Laboratories, Inc. applicable standards.
 - 2. National Electrical Code.
- C. Design Criteria: National Electrical Manufacturers' Association construction types based on environment.
 - 1. Indoor – NEMA Type 1
 - 2. Outdoor – NEMA Type 3R

1.04 SUBMITTALS

- A. Shop drawings will include dimensions, knockout sizes and locations, material types and gauges, finishes, and installation.
- B. Certificates shall include labels of Underwriters' Laboratories, Inc., and National Electrical Manufacturer's Association affixed to each item.
- C. Submittals shall be configured for approval as spelled out in the Specification Manual

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General Electric

2.02 MATERIALS

- A. For Panel boards:
 - 1. Same manufacturer as panel boards, boxes of code gauge steel, welded with edges turned to receive trim, and galvanized. Hinged door, flush tumbler lock and catch keyed alike throughout the work, factory enamel finish, suitable for field color coat.
 - a. Flush – Overlap minimum $\frac{3}{4}$ inches top, bottom, and sides
 - b. Surface – same size as cabinet.
- B. For communications systems, same as for panel boards. Provide $\frac{1}{2}$ " plywood backboard for telephone cabinets, otherwise steel back plates for mounting equipment.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine structure to which cabinets are to be secured for defects, which affect the execution and quality of work.
- B. Do not start work until defects are corrected.

3.02 PREPARATION

- A. Carefully measure and lay out exact locations.
- B. Provide support.

3.03 INSTALLATION

- A. Provide cabinets where indicated and where necessary.
- B. Provide flush type in finished areas centered in paneling and other Architectural features.
- C. Provide surface type equipment rooms.
- D. Install lighting and power cabinets with tops 6 feet 6 inches above finished floor.
- E. Install cabinet fronts straight and plumb. Arrange so that panel boards will be centered in door opening.
- F. Install cabinet trim and doors straight and plumb.
- G. On inside of doors, provide engraved nameplate giving correct designation as scheduled.
- H. All interior housekeeping pads shall be a minimum of 4" thick concrete and have a minimum of 6" clear surface area on at least three sides of the pad after equipment is installed.

- I. Housekeeping pads for exterior use shall be a minimum of 4" thick concrete except when poured adjacent to or attached to the foundation of building which then shall be the same thickness of the building slab and be finished in height elevation the same as the finished first floor elevation of the building and shall have a minimum of 6" clear surface area on at least two sides and front of the pad after equipment is installed.

3.04 ADJUSTING AND CLEANING

- A. Adjust trim and doors for vertical and horizontal alignment.
- B. Clean surface to be painted.

END OF SECTION

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SECTION 16134 OUTLET BOXES

PART 1 – GENERAL

1.01 SCOPE

- A. Provide outlet boxes for the installation of wiring devices, lighting fixtures, equipment, junctions, splices, pulls, power and control connections unless box is an integral part of a device, fixture or piece equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Masonry
- C. Painting
- D. Supplementary Electrical Provisions Section 16010
- E. Wiring Devices Section 16140
- F. Lighting Section 16500
- G. Fire Alarm System Section 16720
- H. Telephone and Raceway System Section 16740
- I. Controls and Instrumentation Section 16900

1.03 COORDINATION

- A. Install outlets at times required to prevent delays in the work and to avoid cutting of masonry units.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Appleton Electric Co.
- B. Raco
- C. Steel City
- D. Crouse Hinds
- E. Carlon Outlet Boxes

2.02 INTERIOR STAMPED STEEL BOXES

- A. Labeled per U.L. #514, NEMA OS-1, and NFPA 70-370.
- B. Boxes, extensions and trims formed of code gauge galvanized steel with conduit knockouts and threaded holes with screws for devices, and/or cover plate mounting.
- C. Types and Minimum Sizes:
 - 1. Rectangular Single Gang: 3"Hx2"D colored jacket.

2. Rectangular Multi-Gang: 3"H x 2"W per gang x 2"D.
3. Octagonal: 4"W x 1-1/2"D.
4. Square: 4" Square x 1-1/2"D.

2.03 MASONRY/TILE BOXES

- A. Labeled per U.L. #514, NEMA OS-1, and NFPA 70-370.
- B. Rectangular boxes formed of code gauge galvanized steel for use in masonry type construction with conduit knockouts and threaded holes with screws for devices and/or cover plates.

2.04 CONCRETE BOXES

- A. Labeled per U.L. #514, NEMA OS-1, and NFPA 70-370.
- B. Boxes, extensions and trims for encasement in concrete formed of code gauge corrosion-resistant galvanized steel with conduit knockouts and threaded holes with screws for devices, and/or cover plate.

2.05 CAST METAL BOXES

- A. Labeled per U.L. #514, NEMA OS-1, and NFPA 70-370.
- B. Boxes, cast malleable iron or copper-free aluminum with corrosive-resistant finish, NEMA 3R type for damp/wet locations, NEMA 4X for areas subject to wash or hose downs, threaded conduit entries, neoprene cover plate gaskets, and threaded holes with screws for mounting devices and or cover plates.

2.06 CAST FLOOR BOXES

- A. Labeled per U.L. #514, NEMA OS-1, and NFPA 70-370.
- B. Rectangular shaped flush-in-floor type boxes of corrosion resistant cast malleable iron construction, waterproof, with adjustable pre-pour leveling, and adjustable post pour top leveling. Single or multi-gang one piece unit as required. Equal to Wiremold #88OCS1-1 w/brushed stainless carpet and tile flange #817b and brushed stainless duplex receptacle cover #828r.
 1. Receptacle: Hinged flip-top with hold-down screw Finish to match floor out box.
 2. Telephone/Alarm/CRT: Threaded cover plate (match floor outlet for finish) plug for un-activated outlets. 1½" diameter nipple with insulated bushing for activated outlets.
 3. Carpet trim: Lexan carpet trim.

2.07 JUNCTION BOXES AND PULL BOXES

- A. Labeled per U.L. #514, NEMA OS-1, and NFPA 70-370.

- B. NEMA I Locations: Galvanized sheet metal enclosure with welded seams, neoprene gasket, hinged cover secured with stainless steel screws or bolts, field cut conduit entries.
- C. NEMA 3R Locations: Enclosure cast of malleable iron or copper-free aluminum corrosion-resistant finish, threaded conduit entries, neoprene gasket and stainless steel fasteners and hardware.

2.08 PLASTIC WIRING BOXES

- A. Plastic boxes are not acceptable.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine building structure to which outlet boxes are to be secured for defects, which affect the execution and quality of work.
- B. Do not start work until defects are corrected.

3.02 PREPARATION

- A. Carefully measure and lay out locations in conference with the Owner's representative.
- B. Owner may change outlet box locations a distance of 8 feet before rough in without additional costs.

3.03 INSTALLATION

- A. Location: Outlet locations indicated on the plans are approximate. Coordinate and determine the exact location of any outlet eight (8) feet before it is permanently installed.
- B. Mounting: Install boxes plumb when vertical, level when horizontal and flush with adjacent surface when recessed.
- C. Architectural Features: Where outlet occurs in an architectural feature, center the outlet in same.
- D. Mounting Height: Where the mounting height of a wall outlet is not specified, mount the outlet at height directed by Engineer. Mounting heights are finished floor.
 - 1. Wall Switches: 48 inches
 - 2. Convenience Outlets: 18 inches
 - 3. Telephone Outlets: 18 inches
 - 4. Boxes Indicated Above Counters: 3 inches to bottom of box, above top of backsplash and trim.
- E. Masonry Joint: The contractor may, with Architect's approval, slightly vary an outlet's mounting height so that the box's top bottom occurs at a masonry joint.

- F. Vertical Alignment: Where outlets occur at different levels and are adjacent to each other, install them on the same vertical centerline.
- G. Wall switches: Space wall switch outlets with first gang box 6" from door trim.
- H. Accessibility: Locate boxes and conduit bodies so that covers are accessible and removable.
- I. Trim: Provide trim rings for all boxes set in plaster, masonry, tile walls or ceilings.
- J. Masonry Cuts: Limit masonry cuts for outlet boxes so that cover plate covers the cut.
- K. Configuration matchbox configuration to applications.
- L. Size: Utilize box size (capacity) based on National Electrical Code.
- M. Device support for devices, utilized boxes designed to support the device independently of cover plate and so install.
- N. Knockout and Thread Openings: cover unused conduit openings with plastic covers for sheet steel boxes and thread plugs for cast boxes.
- O. Clean: prior to pulling conductors or installing devices, clean boxes of dirt, debris and water.
- P. Cover: Cover all boxes and secure with screws or bolts.
- Q. Pull Boxes: Install pull boxes to limit pulling distance and/or pulling loads.
- R. Back to Back Outlets: Do not install through the wall and back-to-back boxes.
- S. Brick Walls: In brick finished walls, locate to work brick in a brick course, where possible, and to permit conduits and raceway to enter from the rear without cutting brick, where possible.

3.04 APPLICATION

- A. Interior Stamped Steel Boxes:
 - 1. Utilize where box will be dry and flush mounted.
 - 2. In stud type wall, masonry/tile walls and ceilings.
 - 3. In joist hung or suspended ceilings, concrete/masonry/tile ceilings.
 - 4. In plenums above accessible ceilings.
 - 5. For wiring of system devices and lighting fixture back boxes.
 - 6. For junction boxes where conduits are less than 1-1/3" trade size.
- B. Masonry/Tile boxes:
 - 1. Utilize where box will be dry and flush mounted.
 - 2. In concrete, masonry or tile walls.
 - 3. In concrete, masonry or tile ceilings.
 - 4. For wiring of system devices and lighting fixture back boxes.
- C. Concrete Boxes:
 - 1. Utilize where box will be wet or dry and surface or exposed mounted.
 - 2. For wiring, concrete/masonry/tile walls and ceilings, metal walls, ceiling and structural items.
 - 3. For wiring of system devices and lighting fixture back boxes.
- D. Cast Metal Boxes:
 - 1. Utilize where box will be wet or dry and surface or exposed mounted.
 - 2. On walls, concrete/masonry/tile walls and ceilings, metal walls, ceiling and structural items.

3. For wiring of system devices and lighting fixtures back boxes.
- E. Cast Floor Boxes:
 1. Utilize where box will be surface or flush mounted.
 2. In floor slab.
 3. For wiring of system devices.
- F. Junction Boxes and Pull Boxes:
 1. Utilize where box will be surface or flush mounted.
 2. In/on walls, above accessible ceiling, in slab on structure.
 3. For junction or pull boxes where conduits 1/4" diameter and larger trade sizes are utilized.
- G. Box Support:
 1. Support each box from the building structure independently of conduit as follows, utilizing a support system capable of carrying 300% of the load.
 2. Boxes Flush Mounted:
 - a. In stud walls and partitions screw, bolt or clip directly to stud or joist. Screw, bolt or clip to a box brace attached between studs.
 - b. In concrete, masonry, or tile grout box into wall surface when flush mounted. Screw or bolt to wall with expansion shields when surface mounted.
 - c. In suspension type ceiling screw or bolt to a box brace attached to joist, structure or slab. Utilize a threaded rod attached to box with nuts and lock-washers and attached to structure in the same method prescribed for surface mounted boxes.
 - d. Screw or bolt to a box brace attached to the support system of a support rated ceiling system. (Provide written verification of ceiling support system)
 - e. In soil or earth set on a 3" thick gravel bed and compact earth around box.
 3. Boxes Suspension:
 - a. Utilize threaded rods and/or support framing channel to support and prevent lateral movement. Attach rod and/or channel to structure in same method as prescribed for surface mounted boxes.
 4. Boxes Surface Mounted:
 - a. On structural steel bolted directly to steel member, fastened to a spring clip attached to a steel member or to bolt-type beam clamps.
 - b. On concrete bolted to pre-set concrete inserts, to expansion shields set in drilled holes or with power actuated anchor studs.
 - c. On wood screw, bolt or nail.
 - d. On stud type wall screw or bolt directly to stud or to a brace attached between studs.

3.05 CLEANING

- A. Clean surfaces to be painted. Refer to Architectural Specifications.

3.06 ACCESS DOORS

- A. Provide stamped steel access doors at each location where access is required for junction boxes; pull boxes, outlet boxes and conduit boxes that contain electrical wiring. Access doors shall be fully insulated complete with mounting flange, double thickness door, and cam latch, gasket and retaining wire. No tools shall be required to open the access door.
- B. The minimum size of each access door shall be sufficient to provide adequate access for the intended purpose of installation.
- C. Provide access doors equal to Nailor-Hart Industries, Inc., series 0800.

END OF SECTION

**SECTION 16140
WIRING DEVICES**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide wiring devices, and cover plates for outlets designated to receive them.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Supplementary Electrical Provisions Section 16010
- C. Outlet Boxes Section 16134

1.03 QUALITY ASSURANCE

- A. Source Quality Control: Test to meet applicable Underwriters Laboratories, Inc. Standard
 - 1. Underwriters Laboratories, Inc. applicable standards.
 - 2. National Electrical Code.
 - 3. National Electrical Manufacturers' Association, No. WD-1, Wiring Devices.

1.04 SUBMITTALS

- A. Samples: Provide samples upon specific request.
- B. Certificates:
 - 1. Labels of Underwriters' Laboratories, Inc. affixed to each item of material.
 - 2. If materials are by manufacturers other than those specified, submit Certification that material meets applicable Underwriters' Laboratories, Inc., Standards.
- C. Produce Data: If materials are by manufacturers other than those specified, submit product data manufacturers' product data describing material and electrical ratings.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bryant
- B. Pass and Seymour
- C. Hubbell
- D. Arrow Hart
- E. GE
- F. Leviton

2.02 GRADE

- A. Commercial Grade or above for 125v duplex grounding receptacles and 120/277v switches. Current 20 Amps. NEMA WD 1, Heavy Duty AC only general use snap switch.
- B. Body and Handle: white plastic with rocker handle.

2.03 MATERIALS

- A. Wiring Devices: Refer to Schedule
- B. Cover plate for Wiring Devices: Hard plastic, smooth finish, color as specified on drawings. If not specified color shall be white. Attachment screws shall also be white. Exceptions to this are noted in "D" below. NYLON wall plate covers are not allowed or accepted.
- C. Weatherproof Cover Plates: Corrosion resistant finish stamped metal or die cast plate cover, w/ spring loaded duplexes outlet cover, and gasket. All exterior duplexes and covers shall be flush with or not protrude from the building or J mold device in which they are installed.
- D. Color Of Devices:
 - 1. All outlets, switches and covers shall be white with the following exception. All Ambassador Penthouse outlets switches and covers shall be ivory in color, except where boxes are installed in stained wood, and then they will be of a dark brown color to blend with the stain color. All attachment screws shall be the same color of the plate used.
- E. Devices shall be Specification grade, UL and CSA certified, listed NEMA Standard, and suitable for the service required in the intended use of the device in this installation.
- F. Other receptacles: Other receptacles shall be of type and characteristics and NEMA configuration to provide service as indicated for the special service as indicated elsewhere.
- G. Cover plates:
 - 1. General: Opening in Plates shall properly fit the wiring devices associated with the outlets. Plates shall overlap outlet box edges for installation over finished room surfaces and shall be the non-overhanging type to fit conduit boxes used with exposed conduit runs. All plates shall be smooth.
 - 2. Telephone outlet: One-hole plate with 5/8" opening designed for the purpose intended. Color shall be the same as noted in "B" & "D" above
 - 3. Future or abandoned outlet, blank plate. Color shall be the same as noted in "B" & "D" above

PART 3 – EXECUTION

3.01 INSPECTION

- A. Each device shall be suitable for the type of service for which it is installed. Device shall be of NEMA configuration and of Specification Grade for those

services to which the device is installed where those standards are established. Devices indicated adjacent to each other shall be in the same box and set under a common plate. Suitable barriers shall be provided in the box for separation of each device from adjacent devices where required.

- B. Install suitable cover plates on all wiring devices.
- C. Device colors shall be noted on plans.
- D. Wire all devices with proper polarity and suitably grounded.
- E. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements
- F. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- G. Install switches and receptacles as heights shown on Architect's Drawings.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- J. Install devices and wall plates flush and level.
- K. Install wiring devices only in electrical boxes, which are clean; free from excess building materials, dirt, and debris.
- L. Install galvanized steel wall plates in unfinished spaces.
- M. Install wiring devices after wiring work is completed.
- N. Install wall plates after painting work is completed.
- O. Tighten connectors and terminals', including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B. Use properly scaled torque indicating hand tool.
- P. The Contractor may be directed by the Owner to move a wiring device during the rough-in stage of construction. The Contractor shall move devices at no additional cost if within six (6) inches of where shown on the documents.
- Q. Inspect boxes into which wiring devices are to be installed for defects, which affect the quality and execution of the work.
- R. Do not start work until defects are corrected.
- S. All GFI plugs shall be located in the area they are intended to serve, i.e.; kitchens, bathrooms, etc. No GFI plugs shall be located in dining rooms, bedrooms, etc.

3.02 PREPARATION

- A. Determine where types of wiring devices are to be installed.
- B. Verify devices are of correct size, capacity, and type and NEMA configuration.

3.03 ADJUSTMENTS

- A. Align devices and cover plate vertically and horizontally assuring flush fitting.

3.04 WIRING DEVICE SCHEDULE

A.	125V, 20A, single receptacle, grounding	P&S 5351-I
B.	125V, 20A, duplex receptacle, grounding	P&S 5350-SI
C.	125/250V, 20A, 3 wire receptacle	P&S 6810-I
D.	125V, 30A 3 wire receptacle grounding	P&S 5920
E.	250V, 30A, 3 wire receptacle grounding	P&S 5930
F.	125V, 50A, 3 wire receptacle grounding	P&S 5940
G.	250V, 50A, 3 wire receptacle grounding	P&S 5950
H.	120/277V, 20A, single pole wall switch	P&S 521-I
I.	120/277V, 20A, double pole wall switch	P&S 522-I
J.	120/277V, 20A, three-way switch	P&S 523-I
K.	120/277V, 20A, four-way wall switch	P&S 524-I
L.	125V, 15A, clock hanger receptacle	P&S 2123
M.	125V, 20A, isolated ground receptacle	P&S IG9300-HG
N.	125V, 20A, GFI receptacle	P&S 2981-RI

END OF SECTION

**SECTION 16150
MOTORS AND ELECTRIC POWERED EQUIPMENT**

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Furnish and install all wiring necessary to completely connect all motors, electric powered equipment and electric controlled equipment that is furnished by the Owner, other Contractors, or the Divisions of Work. This includes HVAC equipment, plumbing equipment, fire protection, and similar items that are installed by others.
- B. The Owner, other Contractors, or other Divisions of the Work will furnish locations of equipment and all instructions and wiring diagrams necessary to select the materials required to install this equipment properly. Furnish and install all conduit, wire, boxes and common wiring materials to make the installation complete and operative.

1.02 REFERENCE DOCUMENTS

- A. The Special Provisions for Electrical Work are hereby made a part of this Section of the Work. Refer to Section 16010.
- B. Refer to other Divisions of the Drawings and Specifications for information as to the scope of this work. All notations for electrical work to be "By Electrical" or "By Mechanical" or "See Electrical" or "See Mechanical" shall be deemed instructions for work in Division 16.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. The Owner or other Contractors will furnish and deliver to the job site the motors and other controls for the equipment, which they furnish except as indicated otherwise.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Set in place all switches, and control devices. Furnish and install all supports, conduit, wire, boxes and common install all supports, conduit, wire, boxes and common interlocks and interconnecting wiring for equipment controls and safeties and make all other electrical connections for proper operation.
- B. Furnish and install a suitable disconnect switch for each motor and electric powered equipment which does not have such a disconnect as an integral part of the equipment or which is not within sight of a feeding branch equipment or

which is not within sight of a feeding branch a disconnect. Any HOA switches or devices required for any equipment will be furnished by that trade, installed and wired by the Electrical Contractor if required by license or code otherwise supplying contractor will wire.

END OF SECTION

**SECTION 16160
PANEL BOARDS**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide distribution panel boards and branch circuit panel boards for the electrical distribution system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Painting
- C. Supplementary Electrical Provisions Section 16010
- D. Cabinets Section 16133
- E. Fuses Section 16181

1.03 QUALITY ASSURANCE

- A. Source Quality Control: Test to meet applicable Underwriters Laboratories, Inc. Standards.
- B. Reference Standards:
 - 1. Underwriters Laboratories, No. 50 – Cabinet and Boxes
 - 2. Underwriters Laboratories, No. 67 – Panel boards
 - 3. National Electrical Manufacturers' Association, No. PB-1 Panel boards.
 - 4. National Electrical Code.

1.04 SUBMITTALS

- A. Submit shop drawings in accordance with Architectural Specifications. Include layouts showing cabinet dimensions, conduit entrances, electrical ratings, bussing connections, single line diagrams, device locations and ratings, and cable termination provisions.
- B. Certificates:
 - 1. Labels of Underwriters' Laboratories affixed to each item of material.
 - 2. Labels of Underwriters' Laboratories approval for service entrance use, where affixed to material.
 - 3. If materials are by manufacturers other than those specified, submit Certification that material meets applicable Underwriters' Laboratories, Inc., Standards.
- C. Instructions: Submit manufacturer's written recommendations for storage and protection, installation, field testing, and periodic maintenance.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: In manufacturer's standard packaging, labeled with designations.
- B. Storage: Store at locations where not subject to damage from personnel, equipment, and the elements in accordance with manufacturers recommendations.
- C. Handling: Handle to avoid damage before and during installation.

1.06 JOB CONDITIONS

- A. Protection:
 - 1. Protect panel boards and surrounding surfaces and finishes against damage from personnel, equipment, and the element before, during, and after installation.
 - 2. Cover to prevent entry of rain, water, and foreign material damaging to the panel boards, cabinets, and raceways.
- B. Sequencing: Install at times required to prevent unnecessary delays in the work.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General Electric, Square D, Siemens.
- B. Circuit breakers shall have overload tripping in each pole. Multi-pole breakers shall open all poles simultaneously on manual operation and overload of any pole. Circuit breakers shall have magnetic arc blowout coils and shall be trip free and trip indicating with quick-make, quick-break mechanism.
- C. Circuit breakers shall be provided with high-pressure type solder less lugs of the proper size and type to accept the feeder cables.

2.02 MATERIALS

- A. Fusible Switch Main Switchboard Panel board:
 - 1. G.E., Square D, Siemens or as indicated on plan
 - 2. 3 phase, 4 wire, solid neutral design with sequence bussing and full capacity neutral.
 - 3. Provide scheduled switches, 20,000 Amp. R.M.S., interrupting rating.
 - 4. Provide cabinets. Refer to Section 16133.
 - 5. Provide main lugs only unless scheduled otherwise.
- B. Circuit Breaker Distribution Panel board:
 - 1. G.E., Square D, Siemens or as indicated on plan
 - 2. 3 phase, 4 wire, solid neutral design with sequence bussing and full capacity neutral.
 - 3. Provide scheduled beakers, minimum 20,000 Amp. R.M.S., interrupting rating or as scheduled.
 - 4. Provide cabinets. Refer to Section 16133.
 - 5. Provide main lugs only unless scheduled otherwise.

6. Provide dead-front safety type power distribution panel boards as indicated, with panel board switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solder less pressure type main lug connectors approved for copper conductors. Furnish with copper bus bars with not less than 98% conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections.
 7. Provide bolt-in type heavy-duty molded-case main and branch circuit-breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panel boards with bare insulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panel boards, which mate properly with panel boards.
 8. On Multi section and split-bus panels, the lugs and bus on each and every section shall be of the same current rating as the main over current device protecting the feeder serving the panel and each section shall have a separate neutral, ground bar and conductors. Panel bus shall have double lugs to effect parallel feed of bus bars (rather than series) where scheduled. Feed-thru lugs are not acceptable.
- C. Fusible Switch Distribution Panel board
1. G.E, Square D, Siemens or as indicated on plan
 2. 3 phase, 4 wire, solid neutral design with sequence bussing and full capacity neutral.
 3. Provide scheduled switches, 20,000 Amp. R.M.S., interrupting rating.
 4. Provide cabinets. Refer to Section 16133.
 5. Provide main lugs only unless scheduled otherwise.
- D. Branch Circuit Panel board:
1. G.E., Square D Siemens or as indicated on plan.
 2. Single phase 3 wire and 3 phase 4 wire, solid neutral design with sequence bussing and full capacity neutral.
 3. Provide scheduled circuit breakers, minimum 10,000 R.M.S., interrupting rating or as indicated on plan.
 4. Provide cabinets. Refer to Section 16133.
 5. Provide main lugs only unless scheduled otherwise.
 6. Provide separate ground bus when scheduled.
 7. Cabinets for panel boards shall be by NEC gage sheet steel having steel doors and trim to conform to the cabinet mounting. The trim on cabinets shall be made adjustable with the door. Door shall be mounted with heavy concealed hinges and lockable.
 8. Cabinets shall have wiring space top, bottom and both sides in accordance with the National Electrical Code, but no less than 4-inches wide, with standard knockout
 9. Provide a clear plastic covered typed directory card and cardholder on the inside of each door. Key locks alike and provides the Owner with not less

than 5 keys. Finish shall be gray enamel over a rust inhibitor, except cans may be galvanized.

10. Multi section panels shall be same height and depth.
 11. Interiors shall be completely factory assembled, consisting of rigid frame supporting the rectangular bus, mains, neutral and ground bars. Bussing shall be sized in accordance with Underwriters Laboratories Standards, braced throughout to conform to industry standards governing short circuit stresses in panel boards, and arranged for sequence phasing throughout.
 12. Phase bussing shall be full height without reduction, full size neutral, unless otherwise scheduled, with suitable lug for each outgoing circuit requiring a neutral connection.
 13. Terminals for feeder conductors, branch circuit devices and neutrals shall be UL listed as suitable for type of conductors specified.
 14. Interiors shall be designed such that circuit protective devices may be changed, replaced, or additional circuits added without disturbing adjacent units and without machining, drilling or tapping. In no case shall the width of panel board enclosure be less than 20-inches.
 15. Provide dead-front safety type lighting and appliance panel boards as indicated, with switching and protective devices in quantities, ratings, types, and arrangements shown; with anti-burn solder less pressure type lug connectors approved for copper conductors.
 16. Furnish all panels with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, single-pole circuit breakers, with toggle handles that indicate when tripped. Interrupting rating shall be in excess of the available fault current at the panel in accordance with UL listing for sizes involved, but no less than 10,000 rms symmetrical amperes.
 17. Provide suitable lugs on neutral bus for each outgoing feeder required; provide bare un-insulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panel boards, which mate properly with panel board.
 18. On multi-section and split-bus panels, the lugs and bus on each and every section shall be of the same current rating as the main over current device protecting the feeder serving the panel and each section shall have a separate neutral, ground bar and conductors. Panel bus shall have double lugs to effect parallel feed of bus bars (rather than series) where scheduled. Feed-thru lugs are not acceptable.
- E. Circuit Breakers:
1. Resettable, quick-make, quick break, bolt-in place type for distribution panel and snap-in type for branch circuit panel boards, trip-free with a separate trip positions.
 2. Multiple pole breakers with common trip and one operating handle.
 3. Do not provide handle ties.
 4. Wire with sequence phasing.
 5. Individually mounted circuit breakers shall be molded case, capacity as indicated, in a NEMA Type 1 enclosure unless otherwise noted. Breakers shall be quick-make; quick-break thermal magnetic common trip types,

ambient compensated with trip-free handle and have interrupting rating in accordance with UL listings for sizes required, but not less than 10,000 amperes rms symmetrical, and conform to requirements of NEMA Standard Publication No. AB1-1969. Each unit shall have insulated neutral and/or ground terminal of proper size, where indicated. Lugs shall be UL listed for copper cables.

6. Enclosures:
 - a. Circuit switching/protective devices shall be housed in an enclosure suitable for the environment in which they are located. Provide lifting eyes or brackets.
 - b. Normal indoor locations - NEMA 1 general purpose.
 - c. Outdoor or vault locations - NEMA 3R.
7. Circuit breakers shall be of same manufacturer as panel boards.
- F. Fusible Switches:
 1. 30-600 ampere rating, Class H fuses clips.
 2. 800-1200 ampere rating, Class L fuses clips.
 3. Multiple-pole switched with one operating handle.
 4. Wire with sequence phasing.

2.03 FABRICATION

- A. Construct in accordance with U.L. and NEMA Standards.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Carefully measure and lay out exact locations of panel boards in conference with the Owner's Representative.
- B. Assure that panel boards may be installed without adversely affecting the integrity and appearance of the building structure and with the clearances required by the National Electrical Code.

3.02 INSTALLATION

- A. Provide panel boards of the types and ratings schedules where indicated.
- B. Provide flush and surface mounted types where indicated and scheduled.
 1. Refer to Section 16133.
 2. Provide multi-section cabinets as required and scheduled; one-piece covers and doors, main and sub-feed lugs as required.
 3. Provide hinged doors with flush tumbler lock and catch, all locks keyed alike.
 4. Provide two keys for each panel board.
- C. Provide supports to the building structure, independent of raceways.
- D. Install tops of cabinets as indicated on drawings above finished floor.
- E. Install panel boards in cabinets, centered in door openings
- F. Provide Identification:

1. For Panel boards: Engraved, laminated plastic nameplate, giving panel board designation.
2. For Distribution Panel boards: Engraved, laminated plastic nameplate, giving circuit numbers.
3. For Branch Circuit and Distribution Panel boards: neatly typewritten circuit directory in cardholder inside panel board door:
 - a. For Branch Circuit Panel boards: Identify rooms served using room number corresponding to those finally established at the project.
 - b. For Distribution Panel boards: Identify the equipment served and give circuit designation.

3.03 FIELD QUALITY CONTROL

- A. Perform manufacturer's recommended field test prior to energizing.
- B. Provide copies of test results to the Owner's Representative.

END OF SECTION

**SECTION 16170
MOTORS AND CIRCUIT DISCONNECTS**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide disconnect switches for branch circuit, motor circuits, and items of equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
 - B. Painting
 - C. Equipment
 - D. Mechanical
 - E. Supplementary Electrical Provisions
 - F. Cabinets
 - G. Fuses
- | |
|---------------|
| Division 15 |
| Section 16010 |
| Section 16133 |
| Section 16181 |

1.03 QUALITY ASSURANCE

- A. Source Quality Control: Test to meet applicable Underwriters Laboratories, Inc. Standards.
- B. Reference Standards:
 - 1. Underwriters Laboratories, No. 98 – Enclosed Switches.
National Electrical Manufacturers' Association, No. No.
 - 2. SKI, Enclosed Safety Switch Standard – Type HD.
 - 3. National Electrical Code.

1.04 SUBMITTALS

- A. Submit shop drawings in accordance with Architectural Specifications. Include enclosures dimensions, type, electrical ratings, fuse provision, installation instructions, and nameplate nomenclature.
- B. Certificates:
 - 1. Labels of Underwriters' Laboratories affixed to each item of material.
 - 2. If materials are by manufacturers other than those specified, submit Certification that material meets applicable Underwriters' Laboratories, Inc., Standards.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Provide Switches sized as required by the National Electrical Code based on the equipment actually furnished under Division 11 or Division 15, or provided by the Owner.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General Electric
- B. ITE
- C. Square D
- D. Siemens

2.02 MATERIALS

- A. For single-phase motors under ½ horsepower Allen Bradley Bulletin 600 single-phase manual switch, toggle type, with locking attachment, neon pilot light, heater elements sized per motor nameplate rating, NEMA 1 enclosed indoors, NEMA 4 enclosure exterior, in damp and wet locations, flush and specified for outlet boxes.
- B. For other 250 or 600 volt equipment: NEMA Type HD, General Electric Type TH, fusible and non-fusible as required by NEC, with cover interlocks, with cabinets, with threaded hubs. Refer to Section 16181 and Section 16133.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Inspect building structure to which disconnects are to be secured for defects which affect the execution and quality are corrected.
- B. Do not start work until defects are corrected.

3.02 PREPARATION

- A. Carefully measure and lay out exact locations maintaining working clearance required by the National Electrical Code.

3.03 INSTALLATION

- A. Provide disconnects where indicated and where required by the National Electrical Code.
- B. Install within sight of equipment served.
- C. Provide final connection to equipment served.

- D. Provide nameplate secured to cabinet with designation of equipment served, operating voltage, and circuit designation.

END OF SECTION

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**SECTION 16181
FUSES**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide fuses for over current protection in fusible devices.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Supplementary Electrical Provisions Section 16010
- C. Panel Boards Section 16160
- D. Motor and Circuit Disconnects Section 16170

1.03 QUALITY ASSURANCE

- A. Source Quality Control: Test to meet applicable Underwriters Laboratories, Inc. Standards.
- B. Reference Standards:
 - 1. Underwriters Laboratories, Class RK1.
 - 2. Underwriters Laboratories, Class RK5.
 - 3. Underwriters Laboratories, Class L
 - 4. National Electrical Code.

1.04 SUBMITTALS

- A. Produce Data: Provide manufacturers bulletins and minimum melting and total clearing time charts for each type of fuse.
- B. Certificates: Labels of Underwriters' Laboratories, Inc. affixed to each item of material.

1.05 COORDINATION

- A. Size fuses with the National Electrical Code for the equipment actually furnished to the project under Division 11 or Division 15, or by the Owner.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bussman
- B. General Electric
- C. Chase-Shawmut

2.02 MATERIALS

- A. Class RK1:
 - 1. 250V, LPN-RK, Low-peak
 - 2. 600V, LPN-RK, Low-peak
- B. Class RK5:
 - 1. 250V, FRN-R, Fusetron
 - 2. 600V, FRS-R, Fusetron
- C. Class L: KRP-C, Hi-Cap
- D. GLR in HLR fuse holder.
- E. Other: KTK in fuse holder or block

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Provide Class RK5 fuses for motors feeder circuit, and other circuits not specified below, 0-600 amps.
- B. Provide Class RK1 fuses for lighting loads, 0-600 amps:
 - 1. For Fluorescent Ballasts: Type GLR.
 - 2. For other ballasts and control circuits: Type KTK.
- C. Provide Class L fuses for all applications, 601 lamps and larger.

3.02 SPARES

- A. Carefully measure and lay out exact locations maintaining working clearance required by the National Electrical Code. In addition to fuses consumed during testing, furnish 10%, but not less than three each of each size and type fuses used for the project and store where directed by the Owner.

END OF SECTION

**SECTION 16190
SUPPORTING DEVICES**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide disconnect switches for branch circuit, motor circuits, and items of equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Concrete
- C. Masonry
- D. Supplementary Electrical Provisions Section 16010
- E. Conduits Section 16111
- F. Cabinets Section 16133
- G. Outlet Boxes Section 16134

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Kindorf
- B. Unistrut
- C. Caddy

2.02 MATERIALS

- A. Continuous Slotted Channel: #12 gauge, steel, electro-galvanized, with zinc chromate, bases and dimensions as required for applications
- B. Hanger Rods: Continuous thread, electro-galvanized, with zinc chromate, sizes as required for loads imposed.
- C. Hex Head Cap Screws and Nuts: No. H-113 and No. H-114, respectively.
- D. One-Hole Pipe Strap: Series HS-100, galvanized steel.
- E. Single Bolt Channel Pipe Straps: Steel with machine screw and nut, Series C-105 and series C-106.
- F. Lay-In Pipe Hanger: Series C-149.
- G. Conduit and Pipe Hanger: Series 6N.
- H. Beam Clamps: Series 500, RC, EC, and PC for applications.
- I. Concrete Inserts, Spot: Series D-256 or No. D-255
- J. Concrete Inserts, Channel: Series D-980 or Series D-986.
- K. Riser Clamps: Series C-210.
- L. Cable Supports: O-Z/Gedney Type S.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Carefully layout and provide concrete inserts.
- B. Securely fasten and support conduit and raceways to the building structure.
- C. Suspend horizontal runs of conduits and raceways from the floor and roof construction and 10 feet or less on centers for sizes 2½-inches and greater and 9 feet or less on centers for sizes 3 inches and smaller.
- D. Fasten single runs of conduit to the structure with one-hole pipe straps and beam clamps or hang on rod hangers.
- E. Support multiple runs of conduit and raceways from continuous channel inserts or from trapeze hangers constructed of rod hangers and channels.
- F. Fasten single conduits to rod hangers with adjustable lay-in pipe hangers or for 2-inches and smaller conduits with Series 6H pipe hangers.
- G. Fasten conduits to channel with pipe channel straps
- H. Support conduits and raceways within 3 feet of each end of each bend, of each termination, and at other intervals to maintain horizontal and vertical alignment without sag or deformation.
- I. Do not use cable, strap, and wire hangers and fasteners.
- J. Provide riser clamps for conduits at floor lines. Provide wire and cable support in pull boxes for risers in accordance with NEC section 300-19 and Table 300-19(a).
- K. Install supports to permit equally distributed expansion and contraction of conduits and raceway with expansion joints. Use guides or saddles and U-bolts and anchors designed for equal effectiveness for both longitudinal and transverse thrusts. Submit complete details for review.
- L. Do not support conduits and raceways from equipment connections.
- M. Provide special supports with vibration dampers to minimize transmission of vibration and noises.
- N. Provide trapeze hangers for conduits and raceways where routing interferes with ducts.
- O. Provide hangers, racks, cable cleats and supports for wires and cables in cable chambers and other locations to make a neat and substantial installation.
- P. Provide angle iron and channel supports to the floor and structure for panel boards, cabinets, pull and junction boxes. Support independently from centering conduits and raceways. Provide supports as specified for conduits and raceways for outlet boxes and pull boxes 100 cubic inches and smaller.
- Q. Provide supports sized for the ultimate loads to be imposed.

3.02 CLEANING

- A. Clean surfaces to be painted.

END OF SECTION

Supporting Devices

16190 - 3

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**SECTION 16195
ELECTRICAL IDENTIFICATION**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. All other Sections of Division 16.
- B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for all requirements.

1.03 SCOPE

- A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of identification for electrical equipment as shown and/or as specified.
- B. Work included:
 - 1. Engraved plastic nameplates for all distribution panels and unit panel cards filled out (neatly).
 - 2. Wire and cable markers.
 - 3. Buried conduit markers.
 - 4. Junction and pull box identifications.

1.04 QUALITY ASSURANCE

- A. Nameplates: Engraved three-layer laminated plastic white letters on a black background.
- B. Wire and Cable Markers: Cloth markers, split sleeve or tubing-type.
- C. Buried Conduit Marker: Continuous printed plastic tape.

PART 2 – EXECUTION

2.01 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws. Secure nameplates to inside face of recessed panel board doors in finished locations.

2.02 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panel board gutters, pull boxes, and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

2.03 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates to identify all electrical distribution and control equipment, and loads served. Letter Height: ¼ inch for individual switches and loads served, ½ inch for distribution and control equipment identification.

2.04 BURIED CONDUIT IDENTIFICATION

- A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick.
- B. Provide tape with printing of "Buried Electrical Conduit" or other similar warning. Install directly above buried conduit 12" below finished grade.

2.05 JUNCTION AND PULL BOX IDENTIFICATION

- A. Identify circuits contained within each junction and pull box with permanent marker on cover plate
- B. Provide red permanent marker on all covers of Fire Alarm Junction or Pull Boxes.

END OF SECTION

SECTION 16450 GROUNDING

PART 1 – GENERAL

1.01 SCOPE

- A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Concrete
- C. Metal
- D. Supplementary Electrical Provisions Section 16010
- E. Conduits Section 16111
- F. Wires and Cables Section 16120
- G. Panel board Section 16160

1.03 QUALITY ASSURANCE

- A. Provide grounding of electrical systems in accordance with the National Electrical Code.

PART 2 – PRODUCTS

2.01 GROUNDING ELECTRODE

- A. Bond together the following items to serve as the electric service-grounding electrode:
 - 1. Minimum 20 feet number four AWG copper conductor encased in concrete footing or grade beam in contact with earth.
 - 2. Structural steel building framework.
 - 3. 10'-0" x 5/8" copper weld ground rod.
 - 4. Cold water pipe.

2.02 GROUNDING ELECTRIC CONDUCTORS

- A. Shall be sized in accordance with National Electrical Code to connect these items to the building bus in the service main equipment.
- B. Grounding conductors shall be green colored insulated annealed copper sized, unless specifically indicated otherwise.
- C. System Ground connections shall be Burndy Type GAR or equal.
- D. Cable connections shall be solder less, bolted pressure connectors.

- E. A grounding conductor shall be installed in every conduit and/or provided integral in Cable Systems. All conduit, boxes, fixtures, etc. shall be bonded to the common grounding bus. At boxes provide Appleton or equal, green head, grounding screws. All fluorescent fixture ballast housings shall be securely bonded to the ground system.
- F. Provide electrical grounding system indicated with assembly of materials, including but not limited to:
 - 1. Wires and cables.
 - 2. Connectors.
 - 3. Terminals.
 - 4. Ground rods.
 - 5. Bonding, jumper braids.
 - 6. Surge arrestors.
- G. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.
- H. Ground Rods: Copper-encased steel, $\frac{3}{4}$ " diameter, minimum length 8 feet.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The metallic raceway systems shall serve as equipment grounding conductors for lighting circuit only and shall be installed so as to make an electrically continuous system.
- B. Provide equipment grounding conductors for:
 - 1. Flexible metallic conduits.
 - 2. Rigid non-metallic conduits.
 - 3. Receptacles.
 - 4. Equipment.
 - 5. Transformers.
- C. Conductor splices and connections in inaccessible locations shall be made by thermal fusion weld process.
- D. The common Ground Bus is defined as the main Ground Bus located within the Building Service Entrance main switch and panel. This shall be the common Ground point for all ground connections. Stray grounds to the Building frame and/or structural members will not be permitted. A separate color-coded insulated grounding conductor shall be run in each and every Raceway or Romex. The Grounding conductor shall be of the same insulation as the circuit conductors sized in accordance with Article 250 NEC and as illustrated on the drawings.
- E. Testing
 - 1. At the completion of the Grounding System, Megger test all grounding to the satisfaction of the Owner and Engineer. The Ground System shall Megger 25 OHMS or less.

END OF SECTION

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SECTION 16491 DISCONNECT SWITCHES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. All other Sections of Division 16.
- B. Concrete All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for all requirements, including but not limited to the following:

1.03 SCOPE

- A. Provide all equipment, material, labor, supervision, and services necessary for or incidental to the installation of disconnect switches as shown or indicated on the Drawings and/or as specified.
- B. Work included:
 - 1. Circuit disconnects.
 - 2. Motor disconnects.

1.04 QUALITY ASSURANCE

- A. When requested, provide the Owner with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Provide disconnect switches manufactured by one of the following:
 - 1. General Electric, Square D, or Siemens

2.02 HEAVY-DUTY SAFETY SWITCHES

- A. Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches, of types, sizes and electrical characteristics indicated, rated 600 volts, and incorporating quick-make, quick-break type switches; construct so that switch blades are visible in OFF position with door open. Equip with operating handle, which is pad lockable in OFF position; construct current carrying parts of high-conductivity copper. Provide NEMA Type 3R enclosures.

2.03 COMPONENTS

- A. Motor and circuit disconnects shall have an Underwriters Laboratory Label.
- B. Single Phase Disconnect Switches: Two-pole toggle switch in NEMA type 1 or 3R enclosure as indicated.
- C. Three Phase Motor Disconnect Switches: Three-pole heavy-duty 600 volt as required in NEMA Type 1 or 3R enclosures as indicated.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install circuit and motor disconnect switches as indicated complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

END OF SECTION

**SECTION 16500
LIGHTING**

PART 1 – GENERAL

1.01 SCOPE

- A. Provide lighting fixtures, lamps, accessories for interior illumination of the building.
- B. Furnish and install lighting fixtures, lamps, and accessories for lighting outlets in accordance with the drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Conditions of the Contract
- B. Finishes
- C. Supplementary Electrical Provisions Section 16010
- D. Conduits Section 16111
- E. Wiring Cables Section 16120
- F. Wire Connection and Devices Section 16121
- G. Outlet Boxes Section 16134
- H. Wiring Devices Section 16140
- I. Supporting Devices Section 16190

1.03 QUALITY ASSURANCE

- A. Manufacturers: Exceptions to manufacturers listed with each item shall be made in accordance with Architectural Specifications.
- B. Laboratory Testing: Photometric testing shall be conducted by independent Testing Laboratories, Inc. based on Illuminating Engineering Society published procedures and shall include candlepower distribution tabulation and zonal cavity coefficient of utilization tabulation.
- C. Reference Standards:
 - 1. Underwriters Laboratories No. 57 – Fixtures, Electric Lighting.
 - 2. Underwriters Laboratories No. ??? - LED Lighting

1.04 SUBMITTALS

- A. Submit manufacturers: literature giving materials, finishes, dimensions, coefficients of utilization, and lamp types for each fixture which is the product of one of the listed acceptable manufacturers.
- B. Submit manufacturers: literature giving materials, finishes, dimensions, coefficients of utilization, and lamp types for each fixture which is the product of one of the listed acceptable manufacturers.
- C. Submit samples of fixtures upon specific request.
Make submittals in accordance with Architectural Specifications.

- D. Certificates Labels of Underwriters' Laboratories, Inc.; Certified Ballasts Manufacturers, and Electrical Testing Laboratories affixed to each item of material.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. As Scheduled on plans and Approved by Architect/Owner.

2.02 MATERIALS

- A. Outlet Boxes: Refer to Section 16134.
- B. Conduits: Refer to Section 16111.
- C. Wires and Cables: Refer to Section 16120.
- D. Concrete: Refer to Section 03300.
- E. Fixtures: See 2.01.
- F. Lamps:
 - 1. Manufacturers: See fixture schedule
 - 2. LED:
 - a. 5000 deg.
- G. Accessories: Manufacturer's standard mounting rings, trim flanges, hanger bars, spacers, supports, plaster frames of non-ferrous material or cadmium plated steel. Do not use painted steel plaster frames.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Inspect Architectural drawings and specifications, including ceiling alternates, to determine ceiling material to be installed.
- B. Inspect Architectural reflected ceiling plans.
- C. Inspect installed ceiling components for defects affecting the quality and execution of work.

3.02 PREPARATION

- A. Verify ceiling material and alignment.
- B. Lay out exact locations of fixtures in accordance with reflected ceiling plans, fixtures and switches' outlet boxes and supports.
- C. Provide outlet boxes and conduit.
- D. Provide appropriate hardware to support fixtures and outlet boxes from structure.

3.03 INSTALLATION

- A. Provide lighting fixtures, lamps, switches, control systems, and wiring.

- B. If designation omitted on drawings, provide same type fixture employed in room of similar usage.
- C. Provide spacers for fixtures mounted on low-density ceiling material.
- D. Provide plaster frames for recessed fixtures in plaster ceilings.
- E. Install fixtures in fiber decking and form board so outlet boxes and openings will not be sight exposed.
- F. Prepared fixtures and trim required to be painted. Refer to Section 09900.
- G. Note: Outlet box locations on drawings are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
- H. Install in accordance with manufacturer's instructions, submittal data, and details on the drawings
- I. Each lighting fixture shall be carefully installed in accordance with the manufacturer's directions and to fit the general construction of the walls, ceilings or other areas where the fixture is indicated. Refer to plans, elevations and other details for the exact locations of fixtures. Where details or other instructions do not indicate lighting fixture locations, position the fixtures proportionally in spaces using the arrangement indicated on the electrical drawings plus center, parallel and space the lighting fixtures and rows of fixtures on and with general construction lines.
- J. Mount surface lighting fixtures to the ceiling in accordance with the lighting fixture manufacturer's instructions.
- K. Securely anchor bracket mounted fixtures to maintain vertical and horizontal alignment. Provide that all mounting devices are concealed.

3.04 ADJUSTMENT AND CLEANING

- A. Adjustment:
 - 1. Adjust lamp position for desired effects.
 - 2. Align fixtures with building walls and tile joints.
- B. Cleaning:
 - 1. Remove dirt, grease, and foreign materials from fixtures.
 - 2. Remove fingerprints, smudges, and dirt from fixtures lenses and lamps.

3.05 LIGHTING FIXTURES SCHEDULE

- A. See lighting fixtures schedule on drawings for fixture types, model, manufactures, etc.
- B. **Furnish to UNLV at completion of project one unopened case of each type of light bulb on project. Present all light bulbs to UNLV Project Manager.**

END OF SECTION

**SECTION 16550
LIGHTING CONTROL EQUIPMENT**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Work Specified Elsewhere:
 - 1. Section 16010 – Standard Provisions.
 - 2. Section 16500 – Lighting.
- B. Description of System: Provide lighting control system(s) for:
 - 1. Exterior building lighting.

1.02 QUALITY ASSURANCE

- A. Source Quality Control: Tests to meet applicable UL Standards.
- B. Reference Standards:
 - 1. National Electrical Code (N.E.C.).
 - 2. Underwriters' Laboratories, Inc. (U.L.).
- C. Operation and Maintenance Data: Manufacturer's brochures, giving operation and maintenance instructions and recommended replacement parts lists.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver products in unopened standard manufacturer's containers with manufacturer's labels affixed.
- B. Storage: Store products at location where not subject to damage from personnel, equipment, and the elements in accordance with manufacturer's recommendations.
- C. Handling: Handle products to avoid damage to finishes and components and surrounding areas in accordance with manufacturer's recommendations.

1.04 JOB CONDITIONS

- A. Protection
 - 1. Cover products with suitable material to prevent incursion of water and damaging foreign matter.
 - 2. Protect surrounding areas from damage during installation.
- B. Sequencing: Install products at times required to prevent unnecessary delays in the completion of work and tests required under other Sections and Divisions.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Time Clocks:
 - 1. Paragon Electric Company, Inc.

2. Tork Time Controls, Inc.
3. Intermatic, Inc.
- B. Photocells:
 1. Paragon Electric Company, Inc.
 2. Tork Time Controls, Inc.
 3. Intermatic, Inc.

2.02 MATERIALS

- A. Time Clocks
- B. Photocells
- C. Conduits: Refer to Section 16111.
- D. Wires and Cables: Refer to Section 16120.
- E. Wiring Devices: Refer to Section 16140.
- F. Supports: Refer to Section 16190.
- G. Lighting: Refer to Section 16500.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Before Installation:
 1. Inspect products upon receipt for damages.
 2. Inspect building structure to which products are to be secured for defects which might adversely affect the quality and execution of work.
 3. Do not start work until damages and defects are corrected.
- B. During Installation: Verify that materials and methods of installation are in accordance with submittals:
- C. After Installation:
 1. Inspect installed materials and surround area for damages incurred during installation.
 2. Inspect wire connections for correctness, tightness, and labeling.

3.02 PREPARATION

- A. Field Measurements:
 1. Layout exact locations of materials in conference with the Owner's representative.
 2. Switch locations may be changed a distance of five feet by the Owner's representative without additional charge prior to rough in.
- B. Verify interface requirements for other systems and devices are in accordance with submittals.
- C. Provide supports for materials. Refer to Section 16190.

3.03 INSTALLATION

- A. Install Time Clocks, Conduit, and Power and Control Wiring:
 - 1. To control security (dusk-to-dawn) exterior fixtures.
- B. Install Photocells, Conduit, Power and Control Wiring:
 - 1. To provide "permit signal" to time clock load circuits.
- C. Install Lighting Controls, Conduit, Power and Control Wiring:
 - 1. To control selected interior fixtures at Owner selected times.
- D. Label wiring at terminations and pull, junction, and outlet boxes.
- E. Paint materials required under specifications.
- F. Provide grounding: Refer to Section 16450.
- G. Set clocks operation switches at times required.
- H. Provide demonstration of system and system operation and maintenance instruction for Owner's personnel in accordance with requirements of Division 1.

3.04 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Muggers wiring for shorts between conductors and for grounded and open circuits.
 - 2. Test system operation.

3.05 ADJUSTMENT AND CLEANING

- A. Adjustment:
 - 1. Adjust clocks operation switches as required to provide proper system operation.
 - 2. Adjust installed materials for proper alignment and flush fitting and for proper operation in accordance with manufacturer's recommendations.
- B. Cleaning: Remove dirt, grease, oil, and foreign matter from materials, surfaces and interiors.

END OF SECTION

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**SECTION 16721
FIRE ALARM AND DETECTION SYSTEM**

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. The Fire Alarm System Installing Contractor (herein referred to as the Contractor) shall furnish all labor, equipment, and materials, and perform all operations in connection with the installation of the minimal required fire alarm system.
- B. All bids submitted to the General Contractor shall be quoted as specified on documents and specifications. Any exceptions or substitutions will be considered at submittal time, and will not cause any increase in contract price. Any exception or substitutions that carry a reduced price by industry standards will be deducted from the General Contractor's contract by a negative change order.

1.02 QUALITY ASSURANCE

- A. This specification identifies the essential functional requirements of the automatic fire alarm system. The manufacturer's equipment (hardware and software) and system configuration shall comply with or exceed the functional intent of this specification.
- B. Each component of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category for the intended use by Underwriters Laboratories, Inc. (UL) and shall bear the "UL label". All control equipment shall be listed under UL category UOJZ Control Units System as a single unit. Partial listings, or multiple listings for various major sections of the control equipment, shall not be acceptable.
- C. Electrical components, devices, and accessories shall be Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction.
- D. All control equipment shall have transient protection devices that comply with the requirements outlined in UL 864, Standard for Control Units for Fire-Protective Signaling Systems.
- E. All materials and equipment (control equipment, initiating devices, notification appliances, etc.) shall be new and unused.
- F. All equipment supplied shall be first quality and the manufacturer's best type and latest model capable of complying with all requirements of this specification and shall have been in continuous production and in continuous service in commercial applications for at least one year. Obsolete equipment shall not be used.
- G. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner by an RFI during the bidding process. Failure to do so will not allow increase in cost after the General Contractor contract is signed.

1.03 SCOPE OF WORK

- A. The project includes the design, fabrication and installation of a complete, ready and operational 24 VDC closed-circuit, electrically supervised, addressable, analog, automatic fire alarm system as specified herein and indicated on the drawings.
- B. The work described in this specification shall consist of all labor, materials, services, software, programming, tools, transportation, and temporary construction necessary to design, fabricate, install, program and test the operational fire alarm system.
- C. The scope of work includes the installation of all initiating devices, notification appliances and system control interfaces, etc. inside the building, as indicated on the drawings and identified in this specification.
- D. The scope of work also includes training Owner personnel on the operation of the system, required maintenance tasks and frequencies, and the locations of all equipment necessary to maintain and operate the fire alarm system.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor's responsibilities are as follows:
 - 1. The furnishing and installation of a complete, ready and operational 24 VDC closed-circuit, electrically supervised, addressable, analog, automatic fire alarm system. The system furnishing and installation shall include, but not be limited to:
 - a. Furnishing and installation of a head-end fire alarm control unit (FACU).
 - b. Furnishing and installation of a remote annunciator panel if required by the Authority Having Jurisdiction.
 - c. Furnishing and installation of manual fire alarm stations at exits as indicated on the drawings.
 - d. Furnishing and installation of new photoelectric, addressable analog automatic smoke detectors (in those environments suitable for proper smoke detector operation), as shown on the drawings.
 - e. Furnishing and installation of new fixed temperature heat detectors as shown on the drawings.
 - f. Furnishing and installation of audible and visible notification appliance circuits per floor, as shown on the drawings, and installation of audible and visible notification appliances in all units and public spaces as shown on the drawings.
 - g. Furnishing and installation of addressable monitor modules and addressable control relay modules, as shown on the drawings and described in this specification.
 - h. Furnishing and installation and connection of the required equipment necessary to inter-connect the fire alarm system with other building systems as indicated in this specification and as shown on the drawings.

- i. Furnishing and installation of metal raceway, wire, fittings, and all other accessories required to provide a complete and operable fire alarm system.
2. The installation and wiring of all devices in accordance with the latest published revision of the manufacturer's installation instructions to achieve the system operation and function as specified herein.
3. The development of working drawings for the fire alarm system installation in accordance with the applicable codes, cited in this specification. The Contractor shall submit the working drawings for:
 - a. Review and approval by the Owner, (Note: Drawings shall not be submitted to the authority having jurisdiction until approved in writing by the Owner.)
 - b. Submission to the authority having jurisdiction for review, permit issuance and approval for installation.
 - c. Field installation of the fire alarm system, after the Owner and the authorities having jurisdiction have reviewed and approved the drawings and submittals, and the permit for the installation of the fire alarm system has been issued.
4. The preparation of a minimum of six complete submittal packages identifying the quantities and technical information for all fire alarm system equipment to be provided. Complete manufacturer's technical specifications shall be provided for all substitute components to those identified in these specifications. Substitutions must be approved in writing by the Owner and Engineer prior to installation or purchase.
5. The Contractor is responsible to pay all permit fees required for the installation of the fire alarm system and to obtain the permit from the authority having jurisdiction.
6. Coordinating the installation of the fire alarm system and testing of associated equipment and circuits with all related trades, contractors, equipment maintenance and testing representatives, the Owner and the authorities having jurisdiction. Where applicable, work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:
 - a. Sprinkler water flow and valve supervisory switches. The Contractor shall be responsible for all testing and wiring up to and including connection to all sprinkler water flow switches and valve supervisory switches. All sprinkler water flow and supervisory switches shall be monitored for integrity in accordance with NFPA 72. The Contractor shall coordinate and verify the quantity and location of all sprinkler water flow and supervisory switches with the installing sprinkler contractor.
7. Providing all required documentation (As-built drawings, training materials, Operating and Maintenance (O&M) manuals, Test Plan, warranty, etc.), as specified in this specification.
8. Coordinating the Demonstration Test and the Acceptance Test of the fire alarm system with the Owner and the authorities having jurisdiction.

1.05 QUALIFICATION OF BIDDERS

- A. All contractors connected with the captioned project shall provide proof of competence of both their company and the individual foreman that will be assigned to this project. The Contractor shall have been in the business of installing fire detection, alarm, and control systems for at least five (5) years, acceptable to the Owner. Once assigned, the Contractor's foreman shall not be changed without the approval of the Owner.
- B. The Contractor shall be licensed by the applicable State and/or Local Jurisdiction and experienced in the installation of fire alarm systems in buildings similar to this project. The Contractor shall also have obtained design and inspection approvals for similar projects from authorities having jurisdiction.
- C. The Contractor shall have on-staff a professional engineer (or minimum NICET Level III certified technician) who is legally qualified to practice in the applicable State and is experienced in providing fire protection engineering services. The professional engineer (or minimum NICET Level III certified technician) shall perform and be responsible for the design of the fire alarm system. Engineering services are defined as those performed for installations of fire alarm systems that are similar to those indicated for this project in material, design, and extent.
- D. As a minimum, all bidding contractors shall include the following in the fire alarm system bid to the General Contractor and in the submittals:
 - 1. The names and qualifications of the Contractor's and the equipment supplier's foreman, project manager and project engineer who shall be in responsible charge during the entire project installation. Contractor's and supplier's qualifications shall include years in business, service policies, warranty definitions and prior experience with installations that include the type of equipment that is to be supplied.
 - 2. A list of at least five (5) similar installations with addresses of properties, contact names and types of system equipment installed.
 - 3. The price for the systems as specified, the prices for required and recommended alternatives for equipment, service work not included in the warranty and prices for a service contract. The prices for engineering, fabrication and on-site installation of each system shall include all subcontractor and manufacturer's on-site representative labor costs. The Contractor shall list all deviations and/or exceptions to these specifications as proposed alternatives.
 - 4. Equipment manufacturer's product data sheets for the major components of the proposed system (fire alarm control unit, initiating devices, and notification appliances).
 - 5. Nonconformance to the Qualification of Bidders requirements outlined in this specification shall be cause for immediate dismissal of the Bid Documents without comment.
 - 6. The award of the contract shall be based on the submitted information and all considerations in the best interests of the Owner. Once the contract is awarded, no requested changes for equipment, suppliers or subcontractors

shall be accepted unless justification is made in writing. Once assigned, the Contractor's foreman and the fire alarm technicians shall not be changed without the approval of the Owner. Upon written request from the Contractor, the Owner may authorize changes, but at their sole choice and discretion. The Contractor shall be at risk for any attempt to substitute the equipment suppliers or subcontractors accepted. All cost for removal, relocation, or replacement of a substituted item shall be at the risk of the Contractor.

1.06 CODES AND STANDARDS

- A. The fire alarm system shall comply with all applicable state and local codes, including the International Building Code as adopted and amended by the local jurisdiction, the International Fire Code as adopted and amended by the local jurisdiction, and the National Fire Codes, as referenced and modified by the applicable building and fire codes.
- B. The fire alarm system within the building shall comply with the provisions of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and all State accessibility requirements.
- C. All equipment and devices shall be labeled and listed for the intended use in Underwriters Laboratories, Inc. (UL), UL FPED Fire Protection Equipment Directory.
- D. If a UL listing for a specific device is unavailable, approval by FM Global (FM) or other nationally recognized testing laboratory (NRTL) acceptable to the Owner shall be acceptable.
- E. Installation shall be made in accordance with the applicable provisions of the latest published edition of the following:
 - 1. International Building Code, as adopted and amended by the authorities having jurisdiction.
 - 2. International Fire Code, as adopted and amended by the authorities having jurisdiction.
 - 3. NFPA 13, Standard for the Installation of Sprinkler Systems.
 - 4. NFPA 70, National Electrical Code, as adopted and amended by the authorities having jurisdiction.
 - 5. NFPA 72, National Fire Alarm Code.
 - 6. NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 7. NFPA 101, Life Safety Code, as adopted and amended by the authorities having jurisdiction.
 - 8. The latest published edition of the equipment manufacturers' product datasheets, technical specifications, installation instructions and wiring guidelines.
- F. The systems shall be tested in accordance with the latest edition of the following:
 - 1. NFPA 72, National Fire Alarm Code.
 - 2. The latest published edition of the equipment manufacturers' testing procedures and guidelines.

1.07 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary, apply to this Section.
- B. Drawings supplied with this specification shall be used by the Contractor as a reference for the requirement and location of system components. It shall be the responsibility of the Contractor to visit the site, observe the existing conditions, and confirm the required quantities of devices and specific options for locations of the same.
- C. Documents, including shop drawings, battery standby and voltage drop calculations, and material specifications prepared according to NFPA 72 shall be required for obtaining approval by the Owner and the authorities having jurisdiction.
- D. The requirement of building permits and authorization to proceed shall become part of this specification. The building permits and authorization to proceed shall be obtained and paid for by the Contractor, where applicable.
- E. Prior to commencement and after completion of work, the Contractor shall provide written notification to the authorities having jurisdiction.
- F. The Contractor shall notify the Owner, in writing, when the system is ready for the Demonstration Test and the Acceptance Test. Notification shall be a minimum of one (1) week in advance of the planned tests. The system shall be considered ready for the Demonstration Test, only after all preliminary tests have been made by the Contractor, and all deficiencies have been found and corrected. In addition, two (2) copies of the Contractor's Materials and Test Certificate shall be submitted to the Owner before Owner shall agree to the scheduling of the Demonstration Test.

1.08 ORDER OF PRECEDENCE

- A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:
 - 1. State and local codes shall take precedence over this specification.
 - 2. The National Fire Protection Association Standards shall take precedence over this specification.
 - 3. This specification shall take precedence over the drawings.

1.09 SUBMITTALS

- A. By submitting a proposal to conduct the work as described in these specifications and the accompanied design documents, the Contractor agrees that he has reviewed the documentation to verify dimensions, quantities, installation techniques, and good workmanship and safety precautions and that he understands said documents relative to this project including the applicable referenced local, state and national Codes, Standards and Regulations. Further, the

Contractor agrees that he is familiar with the building layout and understands that the automatic fire alarm system shall be installed in accordance with the herein referenced documents.

- B. The Contractor shall certify in writing that the submittal documentation is in conformance with all of the requirements of this specification and the applicable referenced local, state and national Codes, Standards and Regulations.
- C. The Contractor is responsible to prepare and submit a minimum of six copies of submittals for approval. Each submittal package shall be prepared and presented in a professional manner, be bound and shall include a title page and index. Each section of the submittal shall be numbered. Submittal packages shall be complete. Partial submittal packages will be returned without review. System working plans (contractor shop drawings) and calculations must be prepared and submitted for approval, by a registered professional engineer or a minimum NICET Level III certified technician who is legally qualified to practice in the applicable State.
- D. The Contractor shall not order any equipment and shall not begin any work until the submittals have been approved in writing by the Owner, Engineer and the authorities having jurisdiction. The Contractor shall not perform any installation prior to the receipt of a written by the authority having jurisdiction.
- E. The Owner and Engineer shall review these documents for the limited purposes of checking for general conformance with the design and not to determine accuracy or completeness of other details such as dimensions and quantities. The Owner and Engineer shall not approve means, methods or procedures of construction or installation; nor shall they review for safety precautions.
- F. If submittals are found not to conform to all of the requirements of this specification and the applicable referenced Codes, Standards and Regulations, the Contractor shall be required to revise and re-submit the package with modifications at no additional charge to the Owner.
- G. In the event that the Contractor's submittal package is required to be revised and re-submitted due to nonconformance with this specification, illegibility of the submittal, incomplete submittals, noncompliance with the referenced Codes, Standards and Regulations or nonconformance with pertinent documentation relative to the project, the Contractor shall pay all fees associated with the additional submittal review. Payment of the fee shall be solely the Contractor's responsibility.
- H. Prior to performing any work, the Contractor responsible for the fire alarm system installation shall include the following documentation in addition to those documents required elsewhere in this specification:
 - 1. Sufficient information to describe their qualifications, the work efforts to be performed, and the materials to be provided, including the names and qualifications of the Contractor's and the equipment supplier's project manager and project engineer who shall be in responsible charge during the entire project installation. Contractor's qualifications shall include years in business and prior experience with installations that include the type of equipment that is to be supplied.

2. The manufacturer's technical representative's name and qualifications. Once approved, the representative shall not be changed without approval in writing by the Owner.
3. A schedule indicating the delivery dates of the equipment to be supplied; installation sequence; time frame and the total amount of on-site technical assistance time (in man-hours per phase) that the supplier of the equipment has included in their bid to comply with the requirements of this specification and the Owner's requirements; and demonstration test and final test/acceptance dates to meet the Owner's scheduled project completion dates.
4. Written confirmation of how the manufacturer/supplier plans to comply with the performance operational design of the system and all pertinent information regarding the reliability and operation of the equipment to be supplied.
5. A letter from the equipment manufacturer stating that the equipment to be supplied is not at or near the end of its life cycle and stating that replacement components for all control equipment shall be available from the manufacturer for a minimum of 15 years from the date of installation.
6. A preliminary Equipment List identifying the type, quantity, make and model number of each piece of equipment to be provided under this submittal. The Equipment List shall include the type, quantity, make and model of spare equipment, as specified in this specification. Types and quantities of equipment submitted shall coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings. A final Equipment List shall be submitted with the Operating and Maintenance (O&M) manual, as specified in this specification.
7. A sequence of operation that describes how the system responds during an alarm, supervisory and trouble condition. The description shall include fire alarm control unit LEDs, audible and visible indications; initiating devices, notification appliances, and auxiliary functions. The description shall provide sufficient information so that the exact function of each installed device and appliance is known.
8. Manufacturer's original product datasheets, specifications, installation instruction sheets and descriptive information for all major components of the system. Copies shall not be acceptable. All equipment and devices to be furnished under this contract shall be clearly marked (highlighted) on the product datasheets.
9. Appropriately scaled shop drawings shall be submitted including a riser diagram of the complete fire alarm system and a complete set of point-to-point fire alarm control equipment installation diagrams; typical wiring diagrams are not acceptable.
10. A complete list of current requirements during normal, supervisory, trouble, and alarm conditions for each component of the system.
11. Preliminary battery calculations showing total standby power and total alarm power required to meet the specified system requirements. Final battery calculations shall be submitted with the O&M manual, as specified

in this specification. Battery calculations shall utilize the UL maximum current published in the manufacturer's installation instructions.

12. Preliminary system voltage drop calculations to assure that the system shall operate per the pre-scribed backup time periods and under all voltage conditions per UL and NFPA standards. Final voltage drop calculations and measurements shall be submitted with the O&M manual, as specified in of this specification. Voltage drop calculations shall utilize the UL maximum current published in the manufacturer's installation instructions. Calculation starting voltage shall not exceed 20.4V and end voltage conditions shall not be less than 17V.
 13. Proof of insurance consistent with the Owner's requirements.
- I. Equipment other than specified shall be considered for approval. It shall be the Contractor's obligation to submit data and information to allow the Owner and Engineer time to consider the equality of the substituted items to that specified. It is the Contractor's responsibility to meet the entire intent of the specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of substantial completion of the project and acceptance by the Owner and Engineer. Accepted submittals on substitute equipment shall only allow the Contractor to proceed with proposing a substituted item and shall not be considered equal until such time as the Owner and Engineer has completely accepted the substitute item. The Contractor shall provide the following in writing to the Owner and Engineer a minimum of ten (10) days before the submittal date:
 1. Complete lists, descriptions, and drawings of materials to be used.
 2. A complete riser diagram of the fire alarm system.
 3. All pertinent information regarding the reliability and operation of the equipment to be supplied.
 4. Manufacturer's original product datasheets, specifications, installation instruction sheets and descriptive information for all major components of the system.
 - J. The Owner may request a demonstration of the proposed equipment.
 - K. The Contractor and the equipment supplier shall advise the Owner and Engineer of all anticipated projects that have the same approximate completion dates as this project and what impact they shall have on the timely completion of this project.

1.10 SCHEDULING

- A. It is the Contractor's responsibility to have all wiring, circuit testing and device installation completed in time for the equipment supplier to make all final connections and conduct all tests as outlined in these specifications.
- B. The Contractor shall be responsible for coordinating the Demonstration Test for the fire alarm system with the Owner and Engineer.
- C. The Contractor shall be responsible for coordinating the Acceptance Test for the fire alarm system with the Owner, Engineer and the authorities having jurisdiction.

1.11 AS-BUILT DRAWINGS

- A. During the course of the project, the Contractor shall develop as-built drawings. The Contractor shall be required to show the following on these floor plans for as-built drawings:
 - 1. The exact locations and installation details of all equipment installed including the FACU, annunciator, all initiating devices, monitor modules, control modules and fault isolator modules with the address of each addressed device and all notification appliances.
 - 2. The installed wiring and color-coding and wire tag notifications for the exact locations of all in-stalled junction boxes and terminal cabinets.
 - 3. Specific point-to-point interconnections between all equipment and internal wiring of the equipment. Typical point-to-point wiring diagrams are not acceptable.
- B. The Contractor shall show the equipment and addresses associated with each device, as listed in this specification, on separate sheets and provide as part of the set of as-built drawings.
- C. The on-site as-built drawings shall be available for inspection and review on request by the Owner.
- D. Upon completion of the installation of the system and a minimum of one (1) week prior to the Demonstration Test, the Contractor shall deliver two (2) complete sets of reproducible, full-size, appropriately scaled, as-built drawings to the Owner.
- E. The as-built drawings shall be in a final form for submission for final approvals.

1.12 TEST PLAN

- A. Upon completion of the installation of the system and a minimum of one (1) week prior to the Demonstration Test, the Contractor shall deliver two (2) complete sets of the Test Plan, which shall describe how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. All tests shall be conducted in the presence of the Owner and shall not be conducted until the "Test Plan" is approved.

1.13 OPERATOR AND MAINTENANCE MANUAL

- A. The Contractor shall provide three complete indexed bound sets of the Operating and Maintenance (O&M) manual, as outlined in NFPA 72, a minimum of one week prior to the Demonstration Test of the system. These O&M manuals shall include the following:
 - 1. The final Equipment List identifying the quantities and types of equipment listed by manufacturer's part number.
 - 2. A detailed narrative description of the system inputs, notification, ancillary functions, annunciation, intended sequence of operations, expansion capability, application considerations, and limitations.

3. An equipment datasheet (or specification sheet) on every piece of fire alarm system equipment installed.
4. Operator instructions for basic system operations, including alarm acknowledgement, system re-set, interpretation of system output, operation of notification and ancillary function controls, and changing of printer paper.
5. Standby power calculations and voltage drop calculations that coincide with the equipment that has been installed in the building.
6. A point ID list referencing the signaling line circuit loops and the devices on those loops.
7. A sensitivity report for all smoke detectors at the time of acceptance.
8. The results of the testing of all wiring free from faults, as specified in this specification.
9. A detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed.
 - a. This information shall include manuals that outline inspection, testing and cleaning procedures for all detectors and control equipment, as well as any other special maintenance procedures for any other pieces of fire alarm system equipment installed in the building.
10. Detailed troubleshooting instructions for each trouble condition generated from the monitored field wiring, including opens, grounds, and loop failures.
 - a. These instructions shall include a list of all trouble signals annunciated by the system, a description of the condition(s) that causes such trouble signals, and step-by-step instructions describing how to isolate such problems and correct them (or how to call for service, as appropriate).
11. A service directory, including a list of names and telephone numbers of those who provide service for the system.

1.14 WARRANTY

- A. The Contractor shall guarantee all new equipment installed and new raceways, new wiring and connections to existing wiring from defects in workmanship and inherent mechanical and electrical defects for a period of one (1) year from the date of substantial completion of the project and acceptance by the Owner.
- B. The Manufacturer or the authorized representative shall guarantee all new system equipment for a period of one (1) year from the date of substantial completion of the project and acceptance by the Owner.
- C. Upon completion of the installation of the fire alarm system equipment, the Contractor shall provide the Owner with a signed written statement in the warranty manual, substantially in the form as follows:
 1. "The undersigned, having been engaged as a contractor for Silverleaf Resorts, Inc. confirms that the fire alarm system equipment was installed in accordance with the system manufacturer's wiring diagrams, installation

instructions, and technical specifications provided to us by the manufacturer and the Owner.”

- D. The warranty period shall begin on the date of building substantial or co-issuance of the project and acceptance in writing by the Owner.

PART 2 – PRODUCTS

2.01 QUALIFICATION OF MANUFACTURERS

- A. Acceptable manufacturers of the electronic fire alarm system control/communications equipment include:
 - 1. EST (Edwards)
 - 2. Notifier
 - 3. Siemens Building Technologies
 - 4. Silent Knight
 - 5. Gamewell-FCI (Fire Control)
 - 6. Others as previously approved by Owner
- B. Acceptable manufacturers of the fire alarm signaling devices and pull stations include:
 - 1. Wheelock
 - 2. Federal Signal
 - 3. EST (Edwards)
 - 4. Gentex
 - 5. Silent Knight
 - 6. Others as previously approved by Owner
- C. Distributors of acceptable manufacturer's equipment shall provide documentation indicating that they are authorized by the manufacturer to distribute and service the equipment and that the manufacturer has stated that they have satisfactorily completed all training courses offered by the manufacturer in relation to the equipment provided.
- D. The manufacturer or authorized distributor shall confirm in writing that, within reasonable distance of the job site (no more than 30 miles), there is an established agency which stocks a full complement of parts and offers service during normal working hours on all equipment to be furnished and that the agency shall supply parts without delay and at reasonable cost.
- E. The manufacturer or authorized distributor shall confirm in writing that they will provide on-site emergency repair service within four (4) hours of notification of the requirement for such service. This service shall be provided on a 24-hour per day, seven (7) days per week basis.

2.02 FUNCTIONAL DESCRIPTION OF THE SYSTEM

- A. The system shall include new control equipment which is UL Listed or FM approved to operate with the submitted manual fire alarm boxes, sprinkler water flow switches, valve supervisory switches, heat detectors and smoke detectors,

alert building occupants using audible and visible notification appliances, supervise each system for conditions which would impair proper system operation, annunciate such abnormal conditions, and where applicable, control related equipment as indicated on contract documents.

B. Alarm Condition

1. The system operation shall be such that the alarm operation of any alarm initiating device shall not prevent the subsequent alarm operation of any other initiating device due to wiring or power limitations.
2. The system alarm operation subsequent to the alarm activation of any manual fire alarm box, any system-type automatic detection device (smoke detector or heat detector), or sprinkler water flow switch shall automatically perform the functions contained in this section and operate as follows:
 - a. All audible (horn) and visible (strobe) notification appliances in the building, as designated on the drawings, shall initiate the alarm evacuation sequence.

3. FACU Indication

- a. Alarm conditions shall be immediately displayed on the control unit alphanumeric display as shown on the drawings, indicating all information associated with the fire alarm condition including type of device, its location and the time and date of activation. The red "ALARM" LED shall flash on the control unit until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another initiating device after acknowledgment shall flash the alarm LED on the control unit and the display shall show the new alarm information.
- b. During an alarm condition, a pulsing alarm tone shall sound within the control unit until the alarm is acknowledged.
- c. If the audible alarm signals are silenced for any reason, they shall automatically resound if another initiating device is actuated.
- d. When the alarm signals are silenced by pressing the "ACKNOWLEDGE" pushbutton on the control module, the control unit LED's shall continue to flash until the alarm is reset at the control unit.
- e. The alarm sequence shall be recorded with the time and date of all occurrences in the fire alarm system History Log.

4. Auxiliary Functions

- a. Where applicable, all auxiliary functions shall be connected to and operated by the control unit.

C. Supervisory Condition

1. The control unit shall have a "SYSTEM SUPERVISORY" LED and a supervisory signal "ACKNOWLEDGE" switch.
2. When a supervisory condition is detected, the following functions shall immediately occur:
 - a. The "SYSTEM SUPERVISORY" LED shall flash.
 - b. A pulsing alarm tone in the control unit shall sound.

- c. The display shall indicate all information associated with the supervisory condition, including device, its location within the protected premises, and the time and date of that activation.
 - d. If more supervisory signals are in the system, the operator shall be able to scroll the display to view new signals.
 - e. All system output programs assigned via control-by-event equations to be activated by the particular point in trouble shall be executed, and the associated system outputs (Supervisory Notification Appliances and/or relays) shall be activated.
 - 3. Unacknowledged alarm messages shall have priority over supervisory messages, and if an Alarm occurs during a supervisory sequence, the Alarm condition shall have display priority.
 - 4. Activating the supervisory "ACKNOWLEDGE" switch shall silence the audible signal while maintaining an LED on, indicating the supervisory condition is still in the off-normal state.
 - 5. Restoring the valve or supervisory contact to the normal position shall cause the supervisory service audible signal to pulse thus indicating restoration to normal position. Activating the "ACKNOWLEDGE" switch shall silence the audible signal and restore the system to normal.
 - 6. The activation of any standpipe or sprinkler valve tamper switch shall activate an audible supervisory signal and illuminate the supervisory LED at the control unit.
- D. Trouble Condition
- 1. When a trouble condition is detected, the following functions shall immediately occur:
 - a. An amber "SYSTEM TROUBLE" LED shall light and the system audible signal shall steadily sound when any trouble is detected in the system. Failure of normal power opens or short circuits on the signaling line circuits or the notification appliance circuits, disarrangements in system wiring, failure of the microprocessor or any identification module, or system ground faults shall activate this trouble circuit.
 - b. A trouble signal may be acknowledged by actuating the "ACKNOWLEDGE" switch. This shall silence the control unit trouble buzzer. If additional trouble conditions occur, the trouble circuitry shall resound.
 - c. During an "alarm" condition, all "trouble" signals shall be suppressed with the exception of lighting the amber "COMMON TROUBLE" LED steadily.
 - d. The display shall indicate all information associated with the trouble condition, including type of trouble point, its location within the protected premises, and the time and date of that activation.
 - e. All system output programs assigned via control-by-event equations to be activated by the particular point in trouble shall be executed, and the associated System Outputs (Trouble Notification Appliances and/or relays) shall be activated.

2. Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition shall have display priority.
- E. System Supervision
1. All wiring extending from the FACU enclosure to fire alarm system components shall be supervised for opens, shorts and grounds. Systems containing unsupervised wiring of any type shall not be acceptable.
 2. The occurrence of any fault shall activate the system trouble circuitry, but shall not interfere with the proper operation of any circuit that does not have a fault condition.
 3. Incoming 120 VAC line power shall be supervised so that any power failure shall be audibly and visually indicated at the control unit.
 4. Batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control unit.
 5. Batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control unit.
- F. System Reset
1. A "SYSTEM RESET" button shall be used to return the system to its normal state after an alarm condition has been remedied. Printed messages shall provide operator assurance of the sequential steps (i.e.: "IN PROGRESS", "RESET COMPLETED") as they occur, should all alarm conditions be cleared.
 2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The control unit "ALARM" LED shall remain on. These points shall not require acknowledgment if they were previously acknowledged.

2.03 MINIMUM COMPONENTS

- A. The automatic fire detection and alarm system shall consist of, but not be limited to:
1. Addressable fire alarm control unit (FACU), containing a Central Processing Unit (CPU) power supply, LED indicators, control switches and relays.
 2. Input Devices (water flow switches and tamper switches).
 3. Addressable, analog photoelectric smoke detectors, with standard bases.
 4. Addressable spot-type heat detectors.
 5. Addressable manual fire alarm boxes.
 6. Addressable monitor modules and control relay output modules.
 7. Fault isolation modules (if required by the authorities having jurisdiction).
 8. Annunciation at the FACU, as shown on the drawings.
 9. A permanent record of the alarm signal, time, and date.
 10. A permanent record of the alarm signal, time, and date.
 11. Battery backup supervision.

12. Automatic supervision of alarm initiating circuits and notification appliance circuits.
13. Interconnections with other building systems including, but not limited to, elevators, air handling systems.
- B. All fire alarm devices within units shall be white in color.
- C. The fire alarm system shall be installed in accordance with the requirements of the applicable codes.
 1. Fire alarm systems shall be independent, stand-alone systems that are not an integral part of a security, an energy monitoring and control system (EMCS), or other systems. Fire alarm systems shall be permitted to be monitored by security systems or EMCS systems, but in no way rely on any components of such systems for operation.

2.04 FIRE ALARM CONTROL UNIT (FACU)

- A. The FACU shall provide power, English display status, supervision, control, and programming capability for the fire detection and alarm system.
- B. The control unit shall be located, as specified by the Owner and as shown on the drawings. Panel shall be protected by DTK- 120HW/240HW/120/240HW Equipment Panel/ Dedicated Circuit Surge Protection.
- C. The control unit shall store a record of alarm and trouble events in a nonvolatile history file. This file shall contain, at least, the most recent 500 events, with time and date of each event. It shall be possible to select the number of events to be viewed in the history file so that the entire file does not have to be downloaded. The history file shall remain intact in the event of a loss of AC and battery power.
- D. The control unit shall be modular in construction and receive supervised plug-in component boards to provide system functions as hereinafter specified and/or to accommodate future system expansions.
- E. The control unit shall be capable of being expanded in the future to support a minimum of 250 addressable points (inputs or outputs). The control unit shall be capable of being expanded and field reprogrammed at any time up to the predetermined maximum capacity of the system, without the requirement to return the operating system to the factory for program changes. All field programming shall be done by an authorized manufacturer's representative.
- F. The control unit shall support a minimum of two (2) signaling line circuits. Each signaling line circuit shall support a minimum of 100 addressable input devices or addressable monitor modules and a minimum of 10 output devices. All addressable input and output devices shall be capable of being intermixed on the same signaling line circuit.
- G. The control unit shall accommodate all addressable input devices in alarm simultaneously and shall be capable of operating all output relays while all inputs are in alarm.
- H. Each signaling line circuit shall be loaded to no more than 75% of its manufacturer specified capacity. Additional SLCs shall be furnished and installed as necessary to comply with this requirement.

- I. The control unit shall supply power and communication protocol signals to the addressable input devices over two pairs of wires per signaling line circuit from the control unit. Signaling line circuits shall be field programmable for Style 4 operation.
- J. The control units shall support a minimum of one (1) notification appliance circuit per floor to provide an evenly distributed number of notification appliances per floor and circuit. All visible notification appliance circuits shall be independent from the audible notification appliance circuits. Each circuit's power load shall not exceed 75% of the individual circuit power available from the FACU and new installed circuits shall be Class B (Style Y) circuits. Additional NACs shall be furnished and installed as necessary to comply with this requirement.
- K. Power for all notification appliances shall come from integral power supplies in the control unit. Remote power supplies, if needed, shall be of the same manufacturer as the FACU. The location of all remote control equipment, such as remote power supplies (extenders) shall be approved prior to installation by the Owner. All locations containing remote control equipment (such as a power supply extender) shall be protected with a smoke detector, in accordance with NFPA 72.
- L. The control unit and system wiring requirements shall be specified by the equipment supplier in their bid to the Contractor.
- M. At a minimum, the FACU shall contain the following:
 - 1. Display. A minimum 80 character, highly readable, display. Upon input activation, the display shall provide the following indication:
 - a. A device address display.
 - b. A field programmed English label indicating the location of the device. Custom label verbiage shall be submitted to the Owner and the authorities having jurisdiction, for approval prior to system programming.
 - c. An English description of the type of device activated, such as smoke detector, manual fire alarm box, water flow switch, etc.
 - d. The status of the input: alarm, supervisory or trouble.
 - e. Multiple alarm conditions shall be sequentially displayed automatically at not more than a five (5) second interval until manually acknowledged by priority.
 - 2. Annunciation. Annunciation shall be an integral part of the control system and shall indicate alarm, supervisory and trouble conditions and the corresponding address. The following initiating devices shall be annunciated individually:
 - a. Smoke detectors
 - b. Heat detectors
 - c. Sprinkler water flow devices
 - d. Manual fire alarm boxes
 - e. Valve tamper switches
 - f. Other approved types of automatic fire detection devices or suppression systems.

3. Battery voltage and ammeter readouts shall be available from the LCD display.
 4. Once acknowledged, individual alarms shall be viewed by operating a "next-alarm" switch
 5. Communication Ports. A minimum of one supervised RS232C communication port shall be provided to support a printer or MODEM. Each RS232C port output shall be programmable for printer or display output and shall be programmable to provide access to the control unit's EEPROM operating system to perform the following functions:
 - a. Local or remote system programming. The Contractor shall provide diagnostic software and modem to allow remote connection to the control unit for maintenance and trouble-shooting. The Contractor shall install the modular connections to the RJ11 telephone jacks as provided and located by the Owner. The telephone wiring connections shall be accomplished by the Owner.
 - b. Listing and indicating status of all field devices.
 - c. Capability of performing alarm tests on any or all addressable smoke detectors and contact input devices.
 - d. Monitoring of the system from remote locations via printer, terminal, or computer.
 6. The control unit shall be provided with a "silent" walk test feature. This feature shall allow for testing of the fire alarm system without activating the notification appliances.
 7. Clock. A 24 hour clock shall be provided to continually provide the time of day and day of the week information. During normal standby conditions, the control unit shall display time and date.
 8. Any operation of an alarm silence, supervisory silence, trouble silence, acknowledge, lamp test, relay switches, or system reset switch shall cause a display indication of operation with time and date. These operations shall also be recorded in the system's history file.
- N. The functional operation of the control unit shall be established by programmable software.
1. The operating program shall be contained in nonvolatile EEPROM memory and shall be configurable in any of the following ways:
 - a. At the factory
 - b. At the job site via modem
 - c. At the job site via standard terminal or standard laptop computer. Laptop computers shall utilize standard communications software, such as Procomm or Crosstalk. Systems which require the manufacturer's proprietary software for programming and communication shall not be acceptable.
- O. Access and control of the operating program shall be restricted to proper personnel designated by the Owner.
1. The control unit shall have a minimum of three (3) security levels, and they shall be designated: "EMPLOYEE", "PROPERTY MANAGER", and "MANUFACTURER." Each level shall have individual passwords. Illegal

access attempts shall be rejected by the system and shall be displayed and recorded in the history file with time and date.

2. The "EMPLOYEE" security level shall be the lowest security level and shall only allow access to the system status levels and lists and shall not impair system operation.
 3. The "MANUFACTURER" and "PROPERTY MANAGER" security levels shall allow access to the operating system.
 4. Accessing a programming function that disables normal system operation shall initiate a trouble sequence.
- P. Failure of the CPU(s) in the control unit module or a channel shall light the CPU Error LED and sound the control unit trouble buzzer. Alarms received while the control unit is in this state shall bypass the software and sound the general alarm signals and light the alarm LED.
- Q. The channel modules shall be field programmable to report wire-to-wire short conditions as either an alarm or trouble condition.
- R. The control unit shall be capable of locating input circuit openings by the associated address and initiate the proper display and trouble sequence.
- S. The system response to alarms shall be 2.5 seconds maximum for the first alarm.
- T. The control unit shall contain an integral standby battery to provide continuous power in the event of AC power failure.
1. The batteries shall be capable of providing 24 hours of backup power for the system and enough remaining power to operate all notification appliances for 5 minutes at the end of the 24-hour period.
 2. The calculations for battery standby shall include a "safety factor" (reserve power estimate) of a minimum 15%.
 3. Transfer from AC to battery power shall be instantaneous when AC voltage drops below 85 per-cent input. Transfer to battery standby shall be indicated by display and recorded in the history file with time and date. The indication shall be "AC OFF".
 4. Loss of building power for the system shall automatically and immediately cause transfer of the system to battery power and cause all audible trouble signals to sound. Upon return of building power, the system shall automatically retransfer thereto, and the batteries shall automatically re-charge.
 5. During battery operation, the control unit shall process all inputs. However, the display shall provide five (5) seconds of indication for each new input condition, then turn off to conserve battery power.
 6. The control unit shall have a dual rate battery charger that shall maintain the batteries in a fully charged condition and shall provide recharge of the batteries to full capacity in forty-eight (48) hours.
- U. The control unit shall provide a nonprogrammable DPDT common alarm relay and common trouble re-lay both with contacts rated 2 AMP at 24 VDC.
- V. Output Function Modules. The control unit shall utilize output function modules to control output functions. The modules shall plug into the control unit motherboard. The functions and presence of each module shall be supervised, and "PROPERTY MANAGER" and "MANUFACTURER" password shall enable

the user to request a list that locates the module by panel and slot within system. All modules shall be individually programmable by circuit as hereinafter specified.

1. The Contractor shall field verify the number and location of all auxiliary function control circuits. Additional addressable control relays shall be furnished and installed, as necessary, to comply with this requirement

2.05 SYSTEM FIELD DEVICES (GENERAL)

- A. Connection of initiating devices and notification appliances to appropriate signaling line circuits and notification appliance circuits from each floor shall be as indicated on the installation drawing from the equipment supplier.
- B. Addressable devices shall operate under the following ranges of environmental conditions:
 1. Ambient Temperature: 32-100 degrees Fahrenheit.
 2. Relative humidity: 0-93 percent, non-condensing.
 3. Air velocity: 300 feet per minute.
- C. Devices located on the exterior of the building shall be listed for the application. This includes devices located within the walkways open to the exterior.
- D. Each addressable device shall include a means to assign a unique address code to the device in the field. This address code shall serve as the means by which the system program recognizes the device.
- E. The address of each addressable device shall be clearly and permanently indicated in the base of each detector or on the face of monitor modules, control relay output modules and manual fire alarm boxes.
- F. Failure of any single device shall not hinder the operation of any other devices connected to the signaling line circuit.
- G. Failure of the control unit to properly communicate with any addressable device shall initiate the proper trouble sequence. While in this trouble condition, the control unit shall cause actual alarm input from de-vices to override trouble alarm.

2.06 AUTOMATIC DETECTORS (GENERAL)

- A. All automatic smoke detectors shall be of the addressable, analog photoelectric type and shall be inter-changeably mounted into a common twist-lock base.
- B. The control unit shall recognize changes of detector type in each location and provide proper indication that reprogramming for the affected address is required.
- C. Every automatic detector shall be so located as to be readily visible from the floor. Detector bases shall have Brady, or Owner approved equal, adhesive markers attached to them indicating the address of the detector. Markers shall be installed, by the Contractor, on the inside of the base and lettering shall be a minimum of 12 point.
- D. In general, automatic detectors shall be mounted on the structural ceiling, finished ceiling or finished wall and not on the bottom or side of any type of construction or structure which extends down from the ceiling. The mounting location of every device shall be approved by the Owner.

- E. Automatic detectors shall be located near points where air currents normally intersect. Detectors shall not be located in the direct path of the draft from an HVAC air supply grille, a door, window, or hallway. Detectors shall be installed a minimum of three (3) feet from an HVAC air supply diffuser, in accordance with NFPA 72.
- F. All automatic detectors shall be installed as indicated on the plans and in conformance with all codes and Regulations and these specifications. The detectors shall be installed within five (5) feet of the location shown on the drawings to accommodate construction. The mounting location of every device shall be approved by the Owner.

2.07 ADDRESSABLE PHOTOELECTRIC SMOKE DETECTORS

- A. Addressable analog photoelectric smoke detectors shall be installed in accordance with this specification, as shown on the drawings. Unless otherwise shown on the drawings, these common area detectors shall be spaced at thirty (30) foot centers, and spaced in accordance with NFPA 72 and the manufacturer's installation instructions. Smoke detectors shall only be installed in those environments suitable for proper smoke detector operation.
- B. Photoelectric smoke detectors shall have a general alarm setting in all common spaces of 3.0% - 4.0% per foot obscuration.
- C. The detectors shall provide a combination alarm/power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control unit. The LED shall be placed into steady illumination under an alarm condition. An output connection shall also be provided in the base to connect an external remote alarm LED. The mounting location of every device shall be approved by the Owner.

2.08 DETECTOR BASES

- A. Automatic detectors shall utilize a common, plug-in, twist-lock, tamper-resistant type base that accommodates photoelectric and thermal detectors. Detectors shall be interchangeable to simplify field conversion.
- B. Removal of the detector from the base shall cause a trouble indication at the FACU. Removal of the detector shall not disrupt the alarm circuit wiring or prevent the receipt of alarms from other devices operating in the circuit.
- C. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble condition at the FACU until the proper type of detector is installed, or the system is re-programmed. The system program shall recognize the insertion of a wrong device and shall automatically default to the set point values corresponding to the inserted device, and shall monitor alarm and trouble conditions according to the de-fault parameters.
- D. Provide bases constructed of white, high impact polycarbonate designed for mounting on a standard 3-1/2 inch or 4 inch octagonal or 4 inch square outlet box. Provide screw terminal connections for No. 14 AWG wire.

2.09 SPOT-TYPE HEAT DETECTORS

- A. Addressable heat detectors shall be installed in environments appropriate for proper detection in accordance with NFPA 72 and the manufacturer's installation instructions.
- B. Addressable heat detectors
 - 1. Addressable heat detectors shall be fixed temperature. Fixed temperature detection feature shall be programmable to operate at either 135 °F or 155 °F.
 - 2. Heat detection element shall be epoxy encapsulated electronic design. It shall be thermistor-based, self-restoring and shall not be affected by thermal lag.
 - 3. The detectors shall provide a combination alarm/power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control unit. The LED shall be placed into steady illumination under an alarm condition. An output connection shall also be provided in the base to connect an external remote alarm LED. The mounting location of every device shall be approved by the Owner.
 - 4. Every addressable heat detector shall have Brady, or Owner approved equal, adhesive markers attached to them indicating the address of the detector. The Contractor shall install markers on the outside of the heat detector base and lettering shall be a minimum of 12 point.

2.10 ADDRESSABLE MANUAL FIRE ALARM BOXES

- A. Manual fire alarm boxes shall be installed as shown on the drawings.
- B. Manual fire alarm boxes shall be of the non-coded, double-action type, surface or semi-flush mounted, as selected by the Owner, with integral contact monitor module to provide addressable operation.
- C. Faceplates shall be red with raised white identification lettering.
- D. Stations shall mechanically latch after operation, with a key operated reset feature, keyed the same as FACU.
- E. Manual fire alarm boxes shall be mounted at a maximum height of 48 inches measured to the activating handle, above the finished floor, in accordance with NFPA 72 and the ADA.
- F. Every manual fire alarm box shall have an engraved nameplate permanently installed on its face or Brady, or Owner approved equal, adhesive markers attached to them indicating the address of the station. The Contractor shall install markers on the outside of the manual fire alarm box and lettering shall be a minimum of 12 point.
- G. Where the project is located with 25 miles of a coastline, auxiliary weatherproof covers (Stopper II without horn or approved equal) will be provided for each fire alarm box.

2.11 ADDRESSABLE MONITOR MODULES

- A. Furnish and install addressable monitor modules to supervise and monitor the status of each non-addressable device, such as sprinkler water flow alarm switch and valve supervisory switch contacts.
- B. Each addressable monitor module shall be able to support any number of normally open (N/O) devices. Wiring to the device(s) being monitored shall be Class B supervised (Style C). Module status (normal, alarm, supervisory, trouble) shall be transmitted to the FACU.
- C. Addressable monitor modules shall include a mounting plate for installation in a junction box or shall be mounted in a locked cabinet or approved box, as shown on the manufacturers recommended specifications.
- D. The addressable monitor modules shall provide address-setting means.
- E. Each addressable monitor module shall be provided with a switch to provide a means of disconnecting the initiating circuit to allow work to be performed on the initiating circuit without causing an alarm.
- F. 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 unit.
- G. Every addressable monitor module shall have Brady, or Owner approved equal, adhesive markers attached to them indicating the address of the module. The Contractor shall install markers on the outside of the module cover plate and lettering shall be a minimum of 12 point.

2.12 ADDRESSABLE CONTROL RELAY OUTPUT MODULES

- A. Provide addressable control relay output modules to permit hardwired control capability from the signaling line circuit. Relay contacts shall be DPDT, rated 2 amperes at 24 VDC.
- B. Furnish and install addressable control relay output modules for the functions as specified in this specification.
- C. Each relay shall operate according to the control program resident in the FACU. Relays shall be supervised for trouble conditions (open, short, device missing/failed) at the FACU.
- D. Relay output modules shall include a mounting plate for installation in a junction box.
- E. The relay output module shall provide address-setting means and shall also store an internal identifying code which the control unit shall use to identify the type of device.
- F. An LED shall be provided which shall flash under normal conditions, indicating that the Relay Output Module is operational and is in regular communication with the control unit.
- G. Provide transient suppressors for inductive loads.
- H. Every addressable relay output module shall have Brady, or Owner approved equal, adhesive markers attached to them indicating the address of the module. The Contractor shall install markers on the outside of the module cover plate and lettering shall be a minimum of 12 point.

2.13 FAULT ISOLATOR MODULES (IF REQUIRED BY AHJ)

- A. Fault isolator modules shall provide short circuit isolation for signaling line circuit wiring. Fault isolator modules shall be listed to UL 864, Standard for Control Units for Fire-Protective Signaling Systems.
- B. The isolator module shall mount directly to a minimum 2 1/8 inch deep, standard 4-inch square electrical box, without the use of special adapters or trim rings.
- C. Power and communications shall be supplied by the signaling line circuit.
- D. Fault isolator modules shall report faults to the host FACU.
- E. After the wiring fault is repaired, the fault isolator modules shall test the lines and automatically restore the connection.
- F. Every addressable fault isolator module shall have Brady, or Owner approved equal, adhesive markers attached to them indicating the address of the module. The Contractor shall install markers on the outside of the module cover plate and lettering shall be a minimum of 12 point.

2.14 AUDIBLE AND VISIBLE NOTIFICATION APPLIANCES

- A. General
 - 1. All notification appliances shall be rated at 24 VDC and shall be powered by supervised notification appliance circuits originating from the FACU or remote power extenders listed for this purpose.
 - 2. The notification appliances shall be installed in accordance with the required audibility levels and the required illumination levels as described in NFPA 72.
 - 3. All notification appliances shall be installed in environmental conditions in accordance with their listing and manufacturer's specifications and installation instructions. Where required, notification appliances that is to be installed in outdoor areas or in areas with harsh environmental conditions shall be tested and listed for outdoor use or for weatherproof applications.
 - 4. As shown on the drawings, a weatherproof visible (strobe) notification appliance (tested and listed for outdoor use), shall be installed on the exterior of the building.
 - 5. All notification appliances shall be white in color.
- B. Notification appliance circuits
 - 1. Notification appliance circuits shall not be installed in the same raceway with signaling line circuits unless approved in writing by the fire alarm system supplier.
 - 2. Notification appliance circuits and control equipment shall be arranged and installed so that loss of any one (1) notification appliance circuit shall not cause the loss of any other notification appliance circuit in the systems.
- C. Audible (horn) notification appliances
 - 1. Fire alarm horns shall be listed in accordance with UL 464, Standard for Audible Signaling Appliances.
 - 2. The horn, whether integral with a combination horn/strobe unit or a separate appliance, shall have a minimum output designation from UL of 90 peak

dBa at 10 feet or 15 dBA above the average ambient sound level, whichever is louder.

- D. Visible (strobe) notification appliances
 - 1. All strobes shall conform to the requirements of NFPA 72, UFAS and the ADA and shall be listed to UL 1971, Standard for Signaling Devices for the Hearing Impaired.
 - 2. All visible notification appliance circuits shall be synchronized and have a rated light output as indicated on design drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance with NFPA 72, except as modified herein.
- B. The Contractor shall provide and install all required equipment, labels and accessories necessary for the proper operation of the system.
- C. All work shall be performed in accordance with the best and the most modern practices of the trade. The entire system shall be installed in a neat and workmanlike manner, in accordance with the standard instructions and recommendations of the manufacturer and in accordance with the approved manufacturer's wiring diagrams unless otherwise specifically permitted by the Owner.
- D. The system shall be installed under the supervision of a qualified, trained, NICET (minimum Level III) Certified manufacturer's representative. The technical representative is expected to be on site with the Contractor during the installation of wiring and during the entire time of final connections and testing of the fire alarm system. The system shall be demonstrated to perform all of the functions as specified.
- E. The supervisory work of the qualified manufacturer's technical representative shall include, but not necessarily be limited to, checking all the system wiring connections; advising the Contractor regarding technical details of the installation; and the adjustment and testing of all components of the system in order to ensure a complete and satisfactorily operable system. The manufacturer's technical representative shall be on site, as required by the Owner, during the entire installation and connection of the new control equipment. The technical representative shall monitor all wiring changes and assist the Contractor to ensure a smooth transition to the new control equipment. The cost of the technical representative shall be paid by the Contractor and shall be included in the bid price. The minimum amount of man-hours for this technical representative to be carried is 40 hours. The Contractor shall identify the amount of manufacturer's technical representative's man-hours that shall be provided and the per-hour cost (including the cost for possible overtime hours) for the technical representative's time.

- F. The manufacturer's technical representative shall also be required to instruct designated building and management personnel in the general operation of the system and to give the designated personnel an overview of the system functions when the system is in normal, supervisory mode, alarm mode, and trouble mode, as specified in this specification.
- G. Securely fasten system components, independent of wiring, to their supports.
- H. Any and all boxes that penetrate a one, or two hour wall, ceiling or enclosure shall extend into the drywall section a least ¼ inch so as not to allow any gaps or openings of the UL rated structure.

3.02 WIRING

- A. All wiring shall comply with this section.
- B. The entire wiring and raceway system for the fire alarm system shall be in full accordance with NFPA 70, National Electrical Code.
- C. The Contractor shall furnish all metal raceway, wiring, outlet boxes, junction boxes, cabinets, labels and similar devices necessary for the complete installation of the fire alarm system. All wiring shall be of the type as specified herein and recommended by the manufacturer and shall be installed in metal raceway throughout.
- D. All wiring, conductors and raceways shall be concealed within the construction to the extent possible. Where concealed wiring and or raceways is not possible, the Contractor shall consult with the Owner for the location of the installation.
- E. All raceways and wiring on the exterior of the building shall be installed in minimum ¾-inch liquid-tight, non-metallic tubing.
- F. Terminal cabinets with hinged, lockable red covers, supplied by Space Age Electronics or approved equal shall be provided at all junction points. All conductor splices shall be made on screw-type terminal blocks – wire nuts, butt, crimp or screw type connectors shall not be used. All terminals within a terminal cabinet shall be properly and permanently labeled. All junction box covers shall be painted red.
- G. Raceways containing conductors identified as "Fire Alarm System" conductors shall not contain any other conductors, and no AC carrying conductors shall be allowed in the same raceway with the DC fire alarm detection and signaling conductors.
- H. The conductors for the notification appliance circuits shall not be installed in the same raceway as the conductors for signaling line circuits unless written certification from the manufacturer is supplied to the Owner indicating that the inclusion of these circuits in the same raceway is acceptable and that no additional consideration is needed for these circuits.
- I. All wiring shall test free from grounds and short circuit faults. To ensure all wiring meets this requirement, the wiring shall be tested by the Contractor. The testing results shall be recorded, signed by the Contractor and forwarded to the supplier and the Owner. No connections to the FACU shall be made until the system wiring has been accepted by the equipment supplier.

- J. All wiring for the initiating devices, notification appliances and remote 80 character LCD display shall be solid or stranded copper and shall comply with the appropriate sections of the National Electrical Code. All system wiring size shall be as determined suitable by the manufacturer and in compliance with the National Electrical Code, yet they shall not be any smaller than as specified herein.
- K. Unless otherwise indicated on the design drawings, the following minimum sizes of conductors shall be used for all new wiring:
 - 1. Power Supply Conductors (Primary and Secondary)
 - a. No. 12 AWG
 - 2. Signaling Line Circuit Conductors
 - a. No. 18 AWG
 - 3. LCD Remote Alarm annunciator
 - a. No. 18 AWG
 - 4. Notification Appliance Circuits
 - a. No. 14 AWG
- L. Color coding of conductors shall be approved by the Owner and the authorities having jurisdiction.
- M. Exposed raceways shall be run parallel and perpendicular to the walls and ceilings. Wherever practical, exposed raceways shall be run on the ceiling as close as possible to a wall or as high as possible on a wall. Where exposed raceways shall cross under a structural beam or rib, they shall be run down on one side of the beam or rib, across its bottom, and up to the ceiling on the other side of the beam or rib. No spanning from beam to beam or rib to rib shall be permitted. The use of a raceway body on one side of a beam or rib shall be permitted provided it shall be readily accessible. Where metal raceway is installed exposed, it shall be painted to match the walls and/or ceilings on which it is installed, as instructed by the Owner. The method and location of all exposed raceways shall be approved by the Owner prior to start of any installation work.
- N. Fault isolator modules shall be furnished as required and shall be mounted as directed by the manufacturer. The field location of the fault circuit isolators shall be labeled so that the devices may be easily located, and that location shall be noted on the point-to-point and as-built drawings.
- O. The power employed to operate the fire alarm system shall have a high degree of reliability and capacity for the intended service. Connections to this power service shall be made on a dedicated branch circuit(s). The circuit shall be mechanically protected.
- P. The electrical supply to the FACU shall be equipped with a dedicated fused disconnect with a handle that can be locked in the "power on" position. This disconnect is to be provided at the connection to the normal power supply serving the FACU. Circuit disconnecting means shall have a red marking, shall be accessible to authorized personnel, and shall be identified as "FIRE ALARM CIRCUIT CONTROL." The location of the circuit disconnecting means shall be permanently identified on a nameplate installed on the inside of the FACU.
- Q. All wiring within the control unit shall be neatly served in the panel gutters and be secured by means of Thomas & Betts "Ty-Raps" or by other approved means.

- R. Where penetrations of floor slabs, fire-resistance rated walls and/or smoke barrier walls are made, the wiring shall be sleeved in metal raceway and the penetrations shall be fire-stopped with approved or UL Listed through-penetration fire stop assembly material acceptable to the Owner and the authorities having jurisdiction.
- S. Runs of conduit shall be straight, neatly arranged and properly supported, and shall be parallel or perpendicular to walls and partitions. All wiring in or through plenum areas shall be either Teflon-coated or shall be in conduit as required and approved by local code. Smurf tube may be used if approved by code.
- T. A/C voltage wiring shall not be in the same conduit as Fire Alarm wiring.
- U. No junction boxes shall be installed without access to them. No installations behind drywall ceilings and walls.
- V. All conduits for Fire Alarm wiring shall be no less than $\frac{3}{4}$ ". All Fire Alarms wiring external of building shall be in $\frac{3}{4}$ Liquid-Tite, Non Metallic Tubing.

3.03 DEMONSTRATION TESTS

- A. Upon completion of the installation of the fire alarm system, the Contractor shall provide a minimum of one (1) week's notice to the Owner that the fire alarm system has been satisfactorily tested by the Contractor and the manufacturer's representative and is ready for the Demonstration Test.
- B. At the time of notification, the Contractor shall submit one copy of the approved as-built drawings and the approved Test Plan. The tests shall demonstrate that the operating and installation requirements of this specification have been met.
- C. At the Demonstration Test, the manufacturer's technical representative shall deliver to the Owner an Inspection and Test Report, which shall be completed in conjunction with the Demonstration Test and shall indicate the following:
 - 1. Building information, including name, address, and city.
 - 2. The Contractor's name, address, city and telephone number.
 - 3. The control unit configuration, serial number, access passwords, extent of battery backup, locations of remote annunciator, a description of remote functions, and type of fire department connection.
 - 4. The total quantity of notification appliances, initiating devices, addressable modules, etc.
 - 5. The quantity of alarm signal units, fire alarm boxes, and each type of detector in each area. In addition, the connection position of each device shall be indicated, and, further, indicate the test result of each device and any subsequent action taken.
 - 6. Pertinent comments regarding the installation, operation, testing, inspecting, or other aspects of the system.
 - 7. The manufacturer's technical representative shall print his/her name and affiliation and sign and date the document.
- D. The tests shall demonstrate that the entire control system functions as intended. All circuits and devices shall be tested, including equipment shutdown, alarm signaling devices, horns, strobes and auxiliary functions (including elevator recall and hat flash). In addition, supervision of each circuit shall be tested.

- E. At a minimum, the Contractor shall perform the following:
 - 1. Operate every building fire alarm device to ensure proper operation, correct annunciation at each remote annunciator (as shown on the drawings) and at the control unit and proper operation of all alarms and auxiliary functions. Where applying heat would destroy any detector, they may be manually operated.
 - 2. The signaling line circuits and the notification appliance circuits shall be opened in at least two locations per floor to check for the presence of correct supervisory circuitry.
 - 3. One-half of all tests shall be performed on battery standby power.
- F. Upon satisfactory completion of the Demonstration Test, the Contractor shall leave the system operating for a minimum of one week prior to the Acceptance Test.
- G. If unsatisfactory results occur during or after the Demonstration Test, the Contractor shall be responsible for any and all additional charges incurred by the Owner with respect to corrective action including but not limited to test monitoring and engineering services during the time it takes to obtain Final Acceptance by the Owner. Final Acceptance by the Owner means that the fire alarm system is completely operational and in conformance with this specification and applicable codes and standards, all documentation has been submitted as required by these specifications, and all training as required by these specifications has been completed to the satisfaction of the Owner.
- H. When the testing has been completed to the satisfaction of the Contractor's job foremen, the representative of the manufacturer, a notarized letter co-signed by each, attesting to the satisfactory completions of said testing, shall be forwarded to the Owner.

3.04 ACCEPTANCE TESTS

- A. Before the installation shall be considered completed and acceptable by the awarding authority, the Final Acceptance Test shall be performed. This test shall be coordinated and performed by the Contractor's job foreman, in the presence of a representative of the manufacturer, the Owner, and the authorities having jurisdiction. In order to assure attendance of the necessary representatives, prior to the final test, each representative scheduled to witness the test, shall be provided reasonable notification of the test date by the Contractor (at least forty-eight (48) hours). The test shall not be conducted until all parties agree on the scheduled test date.
- B. The Contractor shall provide all the necessary personnel and equipment to conduct the tests.
- C. At a minimum, the Contractor shall perform the following:
 - 1. Operate every building fire alarm device to ensure proper operation, correct annunciation at each remote annunciator (as shown on the drawings) and at the control unit, and proper operation of all alarm detection and control devices, horns, strobes and auxiliary functions. Where applying heat would destroy any detector, they may be manually operated.

2. The signaling line circuits and the notification appliance circuits shall be opened in at least two locations per floor to check for the presence of correct supervisory circuitry.
 3. One-half of all tests shall be performed on battery standby power.
- D. If the Final Acceptance Test fails, the Contractor shall prepay all costs incurred to the Owner for any and all reacceptance testing. These costs shall be above and beyond any costs incurred by the authorities having jurisdiction for reacceptance testing.
 - E. Upon satisfactory completion of the tests, the Contractor shall leave the fire alarm system in proper working order and without additional expense to the Owner, shall replace any defective materials or equipment provided by the Contractor under this Contract within one year from the date of final acceptance by the awarding authority.
 - F. All cost associated with any false or nuisance alarms directly related to installation or equipment will be the responsibility of the contractor for a period of one year. A letter of guarantee for such shall be issued at the completion of the project for payment of final retention.

3.05 TRAINING REQUIREMENTS

- A. Personnel: Prior to final acceptance of the fire alarm system, the Contractor and supplier shall provide operation training to the Owner's designated personnel. Two training sessions shall be provided. Each training session shall be a minimum of 1 hour and shall be conducted on shift or at a time acceptable to the Owner. Each session shall include an overview of the system and the devices connected to it, emergency procedures (including alarm, trouble and supervisory condition procedures), control unit operation, and safety requirements. Each session shall include a complete demonstration of the system. Dates and times of each training period shall be coordinated through the Owner, not less than two weeks prior to the training session.
- B. Maintenance Technicians: The Contractor shall arrange for manufacturer training representatives to provide the necessary factory training for operation and troubleshooting of the installed equipment to the Owner's Property Manager and/or Facilities Manager. This training shall include providing the Manager with all access codes and written certification that he is authorized to operate and troubleshoot the equipment supplied by the manufacturer. If this training shall be conducted off-site, all additional costs (transportation, lodging, meals, etc.) associated with the off-site training shall be included in the bid for four (4) maintenance personnel to travel to the off-site training location.

END OF SECTION

SECTION 16740
LOW VOLTAGE AND COMMUNICATION TV CABLE SYSTEM

PART 1 – GENERAL

1.01 SCOPE

- A. Provide data outlets where shown on the drawings or as required by owner. Install a dual gang box with single cover box with cover plate, and as specified under Section 16134.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Conditions of the Contract | |
| B. Supplementary Electrical Provisions | Section 16010 |
| C. Conduits | Section 16111 |
| D. Wires and Cables | Section 16120 |
| E. Cabinets | Section 16133 |
| F. Outlet Boxes | Section 16134 |

1.03 COORDINATION

- A. Install outlets, conduit (if required) or wiring, at times required to prevent delays in the work and to avoid cutting of masonry units.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Provide data outlets with cover plates (white) at heights noted on drawings. (18" AFF unless noted otherwise)
- B. Confirm actual locations before installation.
- C. Install as per MEP Drawings.
- D. Confirm location in each unit prior to install.
- E. Provide home runs for each low voltage /cable run from unit termination on wall in each unit to the phone/cable board in the IT room. Provide wiring type for each discipline as specified on drawings.

END OF SECTION

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SECTION 16900 CONTROLS AND INSTRUMENTATION

PART 1 – GENERAL

1.01 SCOPE

- A. Control wiring and conduit systems for HVAC controls shall be by Electrical Contractor under Section 15900 of the mechanical specification, except as noted herein. All other necessary interlock wiring, including power wiring for mechanical equipment and power for shall be by the electrical contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- | | |
|--|---------------|
| A. Temperature Controls | Section 15900 |
| B. Supplementary Electrical Provisions | Section 16010 |
| C. Conduits | Section 16111 |
| D. Wires and Cables | Section 16120 |
| E. Wire Connection and Devices | Section 16121 |
| F. Outlet Boxes | Section 16134 |
| G. Wiring Devices | Section 16140 |
| H. Motor and Circuit Disconnects | Section 16170 |

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Refer to Section 16111, Conduits; Section 16120, Wires and Cables; and Section 16170, Motor and Circuit Disconnects, for material requirements.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Other trades will furnish and set in place all motors, ready for connection. Other trades will furnish and deliver all starters and other equipment for motors, which they furnish. The electrical contractor shall set in place all such starters, switches, and control devices, furnish and install all interconnecting wiring and make all connections ready for operation.
- B. Completely connect all electrical consuming items of mechanical equipment, shop equipment, etc., provided by the Owner or other trades. Outlets of various types have been indicated at equipment locations, but no indications or exact location or scope of work is indicated on the accompanying drawings.
- C. Refer to details and information furnished by the Owner and various equipment suppliers for equipment wiring requirements and to the Plumbing, Heating, Ventilating and Air Conditioning specifications for the scope of the connections

to equipment provided under those sections, and determine from the various trades by actual measurements at the site, and by the direction from the Owner and the Architect the exact locations of all items. Roughing-in drawings, wiring diagrams, etc., required for the proper installation of the electrical work will be furnished by applicable trades furnishing equipment. Request the drawings and information required in writing of the equipment supplier in ample time to permit preparation of the drawings and to permit proper installation of all wiring. Obtain from those furnishing equipment the size and type of service required for each motor or piece of electrical equipment and verify that the service to be installed is compatible.

3.02 INSTALLATION

- A. All conduits shall terminate in conduit boxes on motors where possible. When motors are direct-connected, the conduit may continue rigid into the box, but when motors drive through belts and have sliding bases, a piece of flexible liquid tight conduit not less than 12 inches long shall be connected between the rigid conduit, then terminate the conduit in a conduit at the motor.
- B. Where disconnecting switches are not provided integral with the control equipment for motors, provide and install a disconnect switch in the circuit to each motor where indicated and required by code. Switches shall be installed as close as possible to the motor or controls they serve and they shall be within sight of the motor or control circuit.
- C. Be responsible for installing all conductors and protective devices serving equipment motors furnished by others in strict conformance with all applicable codes, regardless of any discrepancy in plans and/or mechanical equipment sizes variations, unless covered by directives issued by the Architect.

END OF SECTION