UNIVERSITY OF COLORADO DENVER
AHEC Tivoli Fit 2 More Classroom
Project # 17-260488

STATE OF COLORADO
STATE BUILDINGS AND REAL ESTATE PROGRAMS

September 29, 2017

100% CONSTRUCTION DOCUMENTS

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SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by AHEC.
4. Work under separate contracts.
5. University-furnished and installed products.
7. Access to site.
8. Coordination with occupants.
10. Specification and drawing conventions.

B. Related Requirements:

1. Section 01 35 46 “Indoor Air Quality Procedures” for requirements and procedures related to maintaining air quality in adjacent occupied spaces and buildings.
2. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of AHEC’s facilities and for the provision of temporary construction barriers and dust partitions.

1.3 PROJECT INFORMATION

Project Identification: The Tivoli Starz Film Studio (Theater) was constructed in 1984 and is integrated into the AHEC Tivoli Complex. The Theater area is approximately 30,000 g.s.f. and is constructed of cast-in-place concrete and masonry façade. Existing mechanical systems have been renovated. The Tivoli Theater CAM Renovation included rooms 139F and 139G in the basement level.

The project will include the following:

- Demolition of the two theaters including finishes and furnishings, rooms 139F and 139G.
- Salvage and reconditioning of designated items to be reused including but not limited to projection screen, drapes and wall mounted sound panels.
- Leveling and ADA compliance of existing theater sloped floors.
- New finishes and systems as per documents.
- Completion of classroom 139F.
- Completion of the Film Studio room 139G.
- Coordination of furniture and equipment hookups are per documents.
• Provide a fully functioning space as per schedule.

1. Project Location: 900 Auraria Parkway Denver, Colorado 80204

A. Principal Representation: University of Colorado Denver.

2. University's Representative: Sharon Anthony Ph: 303-724-1155


C. Architect/Engineer's Consultants: The Architect/Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. BG Buildingworks (M.E.P.) – Mike T. Reed Ph: 303-278-3820.

2. Rimrock Group (IT/AV) – John Worgan Ph: 719-533-1112

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and, in summary, briefly consists of the following:

1. A tenant improvement to renovate the lower level movie theater room 139F and 139G. Approx. 1,900 sq.ft. of renovation.

1.5 WORK BY UNIVERSITY/ AHEC

A. General: Cooperate fully with University/ AHEC so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by University/ AHEC. Coordinate the Work of this Contract with work performed by University/ AHEC.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.7 UNIVERSITY-FURNISHED AND INSTALLED PRODUCTS

A. University will furnish certain items of equipment/furnishings as shown on the Drawings. Contractor will be responsible for coordinating their work to accommodate these items including, but not limited to, physical space fit, utility connections and rough-in, power wiring and electrical characteristics.

B. Include in Project scheduling the latest times when information for such items is required and so notify the University in writing.
1.8 UNIVERSITY-FURNISHED, CONTRACTOR-INSTALLED PRODUCTS

A. The University will furnish certain items delivered to the jobsite as shown on the drawings. Contractor will receive, unload, move, set in position, anchor and connect such items and put them into operating condition.

B. The Contractor will be responsible for coordinating their work to accommodate these items including, but not limited to, physical space fit, utility connections and rough-in, power wiring and electrical characteristics.

C. Include in Project scheduling the latest times when information for such items is required and so notify the University in writing.

D. Cooperate with University in scheduling the delivery of these items and be responsible for accommodating their storage and protection in the building and their replacement or repair due to damage as a result of Contractor’s operations.

1.9 ACCESS TO SITE

A. General: Contractor shall have limited and restricted use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

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

1. Adjust means and methods of construction based on site limits and restrictions.
2. Locate staging areas only where permitted by AHEC.
3. As part of this Project, replace damaged lawns, sprinkler systems, sidewalks and any other existing site improvements within staging area and access ways.

C. Construction Access and Travel:

1. Use only those entrances, exits, and travel ways on campus roads and within the building designated by AHEC. Contractor's personnel are not permitted in non-designated areas of AHEC's existing facilities. Use only designated travel ways for transporting demolition materials, new construction materials, tools and equipment.
2. Use of other than designated travel ways on campus roads and within existing buildings requires a minimum of 20 business days prior approval by AHEC.
   a. Request variations to traffic flow including temporary fire lane, parking lot, sidewalk and road closures, regulatory signage, and traffic control devices in accordance with AHEC Closure Request available through AHEC Project Manager.
3. Access to the site will be as permitted by AHEC. Prearrange delivery and use of cranes, heavy trucks and other heavy equipment at least 72 hours prior to need through the AHEC’s Project Manager and AHEC Police.
4. Maintain access to fire lanes and campus operations at all times. Provide flag personnel during the ingress or egress of large equipment.
   a. When fire lanes and/or access way must be temporarily disrupted notify AHEC Police and AHEC Parking and Transportation at least 20 business days in advance and reconfirm 72 hours in advance through the AHEC’s Project Manager.
5. Arrange for and obtain all necessary permits from City of Denver for any disruption to or temporary closures of public city streets. Coordinate procurement of permits with AHEC Project Manager.

D. Construction Parking:

1. General: Contractor must pay for all parking and, if available, may be assigned parking spaces in designated contractor parking lots. Parking in lots designated for visitors is not permitted. Make arrangements for designated spaces and payment for long term parking with AHEC Parking Services through the AHEC Project Manager.
2. Provide temporary parking or use designated areas of AHEC’s existing parking areas as applicable to the Project and in accordance with the following:
   a. All parking on AHEC property, including parking on AHEC owned streets, is under the exclusive control and authority of Auraria Higher Education Parking and Transportation Services. Direct policy question to the department.
   b. There is no free parking on campus. Displacement or use of existing parking spaces by Contractor, either for parking or for staging, is a Contractor cost.
   c. Use of existing parking spaces or other areas outside of Contractor’s staging area must be approved in advance by Auraria Higher Education Parking and Transportation Services.
   d. Auraria Higher Education Parking and Transportation Services may require and issue parking permits through the AHEC Project Manager. Permits must be displayed and visible at all times while parked on the campus. Failure to display a permit will result in citations being written and possible removal of the vehicle from AHEC property.
   e. Keep all designated parking areas clean and free of litter and debris. AHEC reserves the right to direct Contractor to clean areas not kept clean and orderly.
   f. Auraria Higher Education Parking and Transportation Services may change parking assignments as deemed necessary, restrict the use of any space(s) or lot(s) at any time, and determine the hours of control and mode of operations for any parking area at any time. Auraria Higher Education Parking and Transportation Services may deny or revoke parking privileges to any person when deemed necessary and/or considered to be in the best interests of the University.
3. Parking on AHEC property is at the Contractor’s own risk. The AHEC and any entity affiliated with it are not responsible for fire, theft, and damage to or loss of contractor’s or subcontractor’s vehicle or any article left therein. Only a license is granted to the user and no bailment is created.

E. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.10 COORDINATION WITH OCCUPANTS

A. AHEC may occupy site and both existing and adjacent building(s) during entire construction period. Cooperate with AHEC during construction and sequence operations to minimize conflicts and facilitate AHEC usage. Perform the Work so as not to interfere with AHEC’s day-to-day operations.

1. Maintain existing exits from existing and adjacent building, unless otherwise indicated.
2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from AHEC and approval of authorities having jurisdiction.
3. Limit construction operations to those methods and procedures which will not adversely and unduly affect the working environment of University’s occupied spaces, including noise, dust,
odors, air pollution, ambient discomfort, poor lighting, hazards and other undesirable effects and
conditions.
4. Coordinate with AHEC Project Manager to schedule jack hammering or activities producing dusty
conditions, excessive fumes or odors during off-hours.
5. When work must be accomplished in areas containing existing furniture, upon a minimum of 3
business days notification of the AHEC Project Manager, AHEC will remove or relocate existing
furniture.
6. Provide not less than 72 hours' notice to AHEC Project Manager of activities that will affect
AHEC’s operations. AHEC Project Manager will coordinate with campus tenants.
   a. Refer to “Work Restrictions” Article of this Section for procedures and notification
      requirements related to utility interruptions.
7. Provide temporary barriers and partitions, or other means as required to protect occupants of
existing building and the general public from injury due to construction activities. Prevent the
spread of dust and dirt to adjacent occupied areas and building.

1.11 WORK RESTRICTIONS
A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having
      jurisdiction.
   2. In planning and executing the Work, take into consideration the special needs of AHEC teaching
      and research settings, for example, supply of critical utilities, noise and dust control, access to
      existing loading docks, occupied buildings, etc.
B. Normal Working Hours: Limit work to normal working hours of 7:00 a.m. to 6:00 p.m., Monday through
   Friday.
   1. Notify AHEC Project Manager of all proposed work outside of normal working hours. Include
dates, times, names and contact information for contractors and subcontractor performing the
   Work with notification. AHEC Project Manager will notify, as appropriate, other AHEC personnel
   and departments including, but not limited to, Building Maintenance and Operations (BMO)
   Directors, BMO assigned representative, Campus Police and Facilities Management.
C. Noise and Vibration: Coordinate operations that may result in high levels of noise and vibration, or other
   disruption to AHEC occupancy with AHEC.
   1. Noise during Normal Working Hours: Identify potentially disruptive construction activities at
      weekly Progress Meeting and adjust active time of day to reduce significant impacts on occupants.
   2. Noise outside Normal Working Hours: Schedule construction work or demolition work outside of
      normal working hours with AHEC Project Manager at minimum of 72 hours in advance.
      a. The maximum permissible noise level is 75 decibels (dBA), measured at the adjacent
         property line.
D. Contractor Identification:
   1. Supervisory staff for the primary contractor must obtain an identification badge. Submit the
      AHEC Access Control Badge Application form through AHEC Project Manager. Submitted
      forms shall be complete with all required information including a letter on company letterhead
      confirming employee status with company and stating whether the company completes
background testing and/or drug screening. Contractor supervision must display badge on site during construction activities.

2. To the greatest extent possible, Contractor’s and subcontractor’s employees must wear a recognizable logo shirt or hardhat identifying them as members of the contractor’s work force.

E. Use of Existing Elevators: Not allowed due to current condition of elevator.

1. Do not block corridors, aisles, passageways or doors leading to elevator except as, and only to the extent approved by AHEC Project Manager.

F. Keys: Submit written request to AHEC Project Manager on AHEC Key Request Form.

1. To the extent the need for keys is demonstrated and required to complete the Work, AHEC Project Manager will issue keys to Contractor.
2. Contractor is responsible for all costs related to lost or non-returned keys.
3. Electrical, mechanical and sensitive research space may require AHEC escort in lieu of issuing keys.

G. Dock Deliveries: Restrict use exclusively to time required to unload and move construction materials.

H. Existing Utility Interruptions: Do not interrupt water, sewer, plumbing, gas, steam, chilled water, oxygen, HVAC, electrical power, lighting, telephone and other related utilities serving AHEC Campus facilities without prior notice to and approval by the AHEC Campus. Coordinate and schedule interruptions in advance through the AHEC Project Manager in strict conformance with AHEC Campus Utility Interruption/Outage Request Procedure. 1. Form of Notice: AHEC Campus MOP form. 2. Time of Notice: Notice for major and minor outages is 8 business days for minor outages and 21 business days for major outages. Outages are considered “minor” confined when they only affect only one system in only one building, all other outages are to be considered “major”. Fire Alarm and Fire Sprinkler Interruptions: When construction activities require interruption of fire alarm or fire sprinkler service, or when dust from construction activities is likely to cause accidental alarm, advise AHEC Project Manager who will submit an interruption request.

1. Form of Notice: University Fire Alarm/Sprinkler Disable Request Form.
2. Time of Notice: Prior to noon on the day before the anticipated interruption.

I. Nonsmoking Campus Buildings: Smoking, chewing tobacco, and other related tobacco product use is not permitted within buildings on campus.

J. AHEC Policies Applying to All Contractors: Comply with AHEC policies applying to contractors including drug policy, sexual harassment policy and tobacco free policy. Obtain copies of AHEC policies from AHEC Project Manager.

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

K. Designated Eating Areas: Restrict consumption of food on project site to designated eating areas as approved by AHEC Project Manager.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

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

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products may be identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00
SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
  A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
  A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS
  A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if University decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

    1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
    2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
    3. Selection of alternates described in this Section may be deferred for possible selection at a subsequent date if so indicated in the Agreement.

1.4 PROCEDURES
  A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

    1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

  B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

  C. Execute accepted alternates under the same conditions as other work of the Contract.

  D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

    1. Alternate descriptions are recognized as abbreviated and incomplete. Correlate the descriptions with applicable Specification Sections and Drawings for the provision of complete and coordinated work.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES
   1. See Sheet A0.1 for list.

END OF SECTION 01 23 00
SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 21 00 "Allowances" for products selected under an allowance, if applicable.
2. Section 01 23 00 "Alternates" for products selected under an alternate, if applicable.
3. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or University that are not required in order to meet other Project requirements but may offer advantage to Contractor or University.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit each request for consideration in format and quantities specified in Section 01 33 00 “Submittal Procedures”. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A or Contractor-generated form with substantially the same information.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by University and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect/Engineer's Action: If necessary, Architect/Engineer in consultation with the University will request additional information or documentation for evaluation within seven calendar days of receipt of a request for substitution. Architect/Engineer in consultation with the University will notify Contractor of acceptance or rejection of proposed substitution within 14 calendar days of receipt of request, or seven calendar days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order.

b. Use product specified if Architect/Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.
PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 calendar days prior to time required for preparation and review of related submittals.

1. Conditions: Architect/Engineer in consultation with the University will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will return requests without action, except to record noncompliance with these requirements:

   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Requested substitution provides sustainable design characteristics that specified product provided.
   c. Substitution request is fully documented and properly submitted.
   d. Requested substitution will not adversely affect Contractor's construction schedule.
   e. Requested substitution has received necessary approvals of authorities having jurisdiction.
   f. Requested substitution is compatible with other portions of the Work.
   g. Requested substitution has been coordinated with other portions of the Work.
   h. Requested substitution provides specified warranty.
   i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00
SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

2. [Construction Manager/General Contractor Agreement CMGC, State Form SC-6.4] for definitions and contractual requirements related to contract modification procedures.

1.3 DEFINITIONS

A. Change Order: A written order in compliance with the requirements of the Contract authorizing changes in the Work. For the purposes of this Section a Change Order and a Contract Amendment shall have the same meaning.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Authorized Signatory: Submit name of individual authorized to accept changes and responsible for informing others employed by Contractor of changes in the Work.

1.5 MINOR CHANGES IN THE WORK

A. Architect/Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.6 CHANGE ORDER BULLETIN

A. University-Initiated Change Order Bulletin: Architect/Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. It will also state the time period for which the request will remain valid.
2. Work Change Order Bulletins issued by Architect/Engineer are not instructions either to stop work in progress or to execute the proposed change.

B. Contractor-Initiated Change Order Bulletin: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect/Engineer.

2. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

1.7 CHANGE ORDER PROPOSAL

A. Change Order Proposal: In response to a University-Initiated Change Order Bulletin or accompanying a Contractor-Initiated Change Order Bulletin, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change described.

2. Labor Rates: Prior to submitting first Change Order Proposal, submit bare, unburdened hourly labor rates for all contractor and subcontractor labor categories; submit itemized breakdown of all applicable additional labor benefit costs to be added to the bare labor cost to arrive at the total burdened hourly labor cost.
3. Equipment Costs: Provide cost backup for all equipment clearly indicating equipment billing rates and sufficient to demonstrate, as determined by the University Project Manager, that proposed rates are competitive and reasonable in all cases. Submit completed Change Order Proposal Form within the requested timeframe. Include backup documentation to support calculations consistent with Contract provisions, including but not limited to, the following:
   a. Contractor and Subcontractor labor, material and equipment costs including:
      1) A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      2) Applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      3) Costs of labor and supervision directly attributable to the change and as permitted by the terms and conditions of the General Contract for Construction.
   b. Contractor and Subcontractor overhead and profit.
   c. Contractor’s bond cost.
   d. Justification for Change in Contract Time: An updated Contractor’s construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
4. Maintain detailed records of work completed. Provide complete information for evaluation of proposed changes and to substantiate proposed changes in Contract Sum or Contract Time.
1.8 ADMINISTRATIVE CHANGE ORDERS

A. Not Used.

1.9 CHANGE ORDER PROCEDURES

A. Submit three signed copies of Change Order Proposal to Architect/Engineer for review.

1. University-Initiated Change Order Bulletins: University and Architect/Engineer will evaluate Contractor’s Change Order Proposal and either request additional information or suggest modifications. Based on this review and evaluation University will either accept or reject the proposal.

2. Contractor-Initiated Change Order Bulletins: Architect/Engineer will evaluate Contractor’s claim based on the terms and conditions of the Contractor Agreement and General Conditions of the Construction Contract, as applicable.

3. Architect/Engineer’s Action: When satisfied as to the accuracy and completeness of the Change Order Proposal, the Architect/Engineer will sign all three copies and forward to the University for consideration.

B. On University's approval of a Change Order Proposal, Architect/Engineer will prepare, sign and forward three copies of a Change Order, State Form SC-6.31 available from the website of the Office of the State Architect, for signature by the Contractor. Contractor then forwards all three copies of signed Change Order to the University for signature and distribution of fully executed copies to Architect/Engineer and Contractor for record.

C. Upon receipt of a fully executed Change Order, promptly perform the following:

1. Revise Schedule of Values on the Application for Payment Form by indicating each authorized Change Order as a separate line item and adjusting the Contract Sum as shown on the Change Order.
   
   a. University will not pay for changes to the Work until authorized by a Change Order signed by all parties.

2. Revise the Progress Schedule to reflect any change in the Contract Time.

3. Enter changes in the Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00
SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor’s construction schedule. Schedule of values report from cost-loaded Critical Path Method Schedule prepared in accordance with Section 01 32 00 “Construction Progress Documentation” may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.

      1) Construction Manager’s Fee.
      2) Estimated Project General Conditions Costs.

2. Submit schedule of values and hold a conference with the Architect/Engineer and University Project Manager to finalize the schedule of values at earliest possible date, but no later than 10 business days before the date scheduled for submittal of initial Certificates and Applications for Payment.
B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
   a. Project name and location.
   b. Name of Architect/Engineer.
   c. Architect/Engineer's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

   1) Labor.
   2) Materials.
   3) Equipment.


4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not a direct cost of actual work-in-place shall be shown as separate line items in the schedule of values.

7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect/Engineer and paid for by University.
PAYMENT PROCEDURES

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Pay Application and Schedule Review Meetings: Conduct in accordance with Section 01 31 00 “Project Management and Coordination.” Provide draft application for payment and draft schedule update reflecting work accomplished during previous pay period. Review progress achieved; discuss and resolve issues affecting the progress; and review critical activities to be accomplished during the following 90 calendar days.

1. Jobsite Walk: When required, conduct a walk of the jobsite to confirm progress related to any activity in question.

C. Monthly Schedule Reporting: Upon conclusion of the Pay Application and Schedule Review Meeting, but not later than the 28th of the month, update the Construction Schedule and submit the Pay Application.

D. Payment Application Times: Submit Application for Payment to Architect/Engineer by the first day of the month and no more than five (5) business days prior thereto. The period covered by each Application for Payment is per the date indicated in the Application.

E. Payment Application Review: The Architect/Engineer shall, within five (5) business days after the receipt of each Certificate and Application for Payment, review the Project Application for Payment and either execute a Project Certificate for Payment to the University or notify the Contractor in writing of the reasons for withholding a Certificate.

1. All applications for payment, except the final application, and the payments thereunder, shall be subject to correction in the next application rendered following the discovery of any error.

F. Application for Payment Forms: Use State Form SBP-7.2 “Certification for Contractor Payment.”

G. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect/Engineer will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under University-requested project acceleration.

H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site as approved in advance by the University Project Manager and items stored at an off-site location previously agreed upon in writing.

1. Provide certificate of insurance, evidence of transfer of title to University, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

I. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect/Engineer by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. For projects required to obtain LEED certification, LEED submittal for project materials cost data.
4. Contractor's construction schedule (preliminary if not final).
5. Products list (preliminary if not final).
6. For projects required to obtain LEED certification, LEED action plans.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
13. Initial progress report.

K. Application for Payment at Substantial Completion: After Architect/Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for University occupancy of designated portions of the Work.

L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:

1. All items on Pre-acceptance Checklist (State Form SBP-05) have been completed.
2. Notice of Acceptance (State Form SBP-6.27) has been issued.
3. Statements to support local sales tax refunds, if any submitted.
4. Notice of Contractor’s settlement has been published.
5. Evidence of completion of Project closeout requirements, including but not limited to:

a. Submittal of Record Documents.
b. Submittal of all Operation and Maintenance Manuals.
c. Completion of all required demonstration and training.
6. Updated final statement, accounting for final changes to the Contract Sum.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when University took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00
SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Within 21 calendar days of Notice of Award submit, as complete as possible, a preliminary list to include all major subcontractors. Augment, complete and submit the final subcontractor list within 60 calendar days of Notice of Award, unless a longer duration is approved by the Architect/Engineer. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
B. Key Personnel Names: Within 14 calendar days after Notice to Proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

A. General: Each entity involved in the performance of work for the entire Project shall cooperate in the overall coordination of the Work; promptly, when requested, furnish information concerning its portion of the Work; and respond promptly and reasonably to the decisions and requests of persons designated with coordination, supervision, administrative or similar authority.

1. University Standard Project Management Forms

   a. Where applicable, obtain from the University Project Manager and use the following University Standard Forms:

      1) Preconstruction Agenda
      2) Change Order Log with Contingency Codes
      3) Access Control Badge Application Form
      4) Utility Interruption Request Form
      5) Utility Start-Up Request Form
      6) Fire Alarm/Sprinkler Disable Request Form
      7) Hot Work Permit Form
      8) Indoor Air Quality (IAQ) Planning Checklist
      9) Indoor Air Quality (IAQ) Inspection Checklist

2. Site Utilization:

   a. In addition to the site utilization limitations and requirements indicated in Section 01 10 00 “Summary” and indicated by the Contract Documents; administer the allocation of available space equitably among entities needing access and space, so as to produce the best overall efficiency in the performance of the total work of the project. Schedule deliveries so as to minimize the space and time requirements for storage of materials and equipment on the site; but do not unduly risk delays in the work.

   b. Concurrent with work of the Contractor, other contractors, suppliers, and the University personnel may be working in relatively close proximity. The Contractor is solely responsible for coordinating their work with that of other contractors and will make no claims for failure to do so.

3. Layout:

   a. It is recognized that the Contract Documents are diagrammatic in showing certain physical relationships of the various elements and systems and their interfacing with other elements and systems. Establishment and coordination of these relationships is the exclusive responsibility of the Contractor. Do not scale the drawings. Layout and arrange all elements to contribute to safety, efficiency and to carry the harmony of design throughout the Work. In case of conflict or undimensioned locations, verify required positioning with Architect/Engineer.
4. **Substrate Examination:**
   
a. The Installer of each element of the work must examine the conditions of the substrate to receive the work, dimensions and spaces adjacent, tolerances, interfacing with other elements and services, and the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper or timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

5. **Large and Heavy Equipment:**
   
a. Contractor to coordinate with University Project Manager requirements to be maintained for the subsequent entry of large equipment units. Coordinate the movement of heavy items with shoring and bracing, so that the building structure will not be overloaded during the movement and installation.

   b. Where equipment or products to be installed on the roof are too heavy to be hand-carried, do not transport across roof deck; position by crane or other device so as to avoid overloading the roof deck.

B. **Coordination:** Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections of the Specification that depend on each other for proper installation, connection, and operation.

1. Contractor Communication with the University: Direct all communication with the University through the University Project Manager.

2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

3. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

4. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for University and separate contractors if coordination of their Work is required.

D. **Administrative Procedures:** Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Preinstallation conferences.

7. Project closeout activities.

8. Startup and adjustment of systems.

E. **Coordination Of Submittals:** Prior to transmittal to the Architect/Engineer, review shop and erection drawings, product data, and samples for compliance with Contract Documents and for coordination.
among work of all Sections of the Specifications. Coordination of submittals shall include, but not be limited to the following:

1. Verification of field dimensions and clearances and relationship to available space and anchors.
2. Verification of compatibility with equipment and work of other Sections, electrical characteristics, and operational control requirements.
3. Verification of motor voltages and control characteristics.
4. Coordination of controls, interlocks, wiring of pneumatic switches, and relays.
5. Coordination of wiring and control diagrams.
6. Review of the effect of any changes on work of other Sections.
7. For any item to be installed in or on a finished surface, certify that applicable Contract Documents have been checked and that the item submitted is compatible with the surface finish on which it is to be installed.
8. Equipment and material submittals shall show sufficient data to indicate complete compliance with Contract Documents as follows:
   a. Proper sizes and capabilities.
   b. Ability to fit in the available space in a manner that will allow proper service.
   c. Construction methods, materials, and finishes.
   d. List of accessories.

F. Special Coordination Requirements for Mechanical and Electrical Work:

1. General: Provide necessary work and services required to coordinate the complete installation of heating, ventilating, and air conditioning (HVAC) equipment and systems; plumbing systems and fixtures; electrical equipment, fixtures, and systems; and other equipment or systems containing motors and controls or requiring connection to mechanical or electrical systems; all so that the various systems perform as indicated and are in harmony with other project Work.
2. Contract Drawings:
   a. Drawings are schematic in nature, and indicate in general how the various components are integrated with other parts of the building. Coordinate exact locations by job measurement, by verifying the requirements of other trades, and by review of Contract Documents.
3. Mechanical and Electrical Drawings indicate general routing of the various parts of the systems, but do not indicate all sizes, fittings, offsets, and runouts which are required. Coordinate correct sizes, fittings, offsets, and runouts required to fit systems into allocated spaces. Coordinate locations of all light fixtures, vents, and supply grilles to conform to the ceiling grid system or other modular finishes.
4. Coordinate installation of mechanical and electrical work in compliance with the following requirements:
   a. Install piping, ductwork and similar services straight and true, aligned with other work, close to walls and overhead structure, allowing for insulation, concealed (except where indicated as exposed) in occupied spaces, and out-of-the-way with maximum passageway and headroom remaining in each space.
   b. Install electrical work in a neat, organized manner with conduit and similar services in or parallel with building lines, and concealed unless indicated as exposed.
   c. For all work maintain maximum practical overhead clearance but not less than 6” above ceiling. Where exposed, maintain 7'-0” minimum clearance.
   d. Arrange all work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
   e. Provide space to permit removal of coils, tubes, fan shafts, filters, other parts which may require replacement.
f. Locate operating and control equipment and devices for easy access. Furnish access panels where units are concealed by finishes and similar work.

g. Integrate mechanical work in ceiling plenums with suspension system, light fixtures and other work, so that required performances of each will be achieved.

h. Give the right-of-way to piping systems required to slope for drainage over other service lines and ductwork.

i. Advise other trades of openings required in their work for accommodation of mechanical and electrical elements. Provide and place sleeves and anchors required in other work.

5. Access to Equipment: Except where located above accessible ceilings, provide access panels wherever access is required to concealed valves, controls, dampers, pull boxes and other devices requiring ongoing or periodic access.

   a. Acceptable types of access panels are specified in Division 08.
   b. Each trade is responsible for providing access panels needed for access to their equipment and coordinating installation with other Division 03, 04, 06 and 09 trades.
   c. Coordinate requirements and obtain approval of locations from Architect/Engineer.

G. Compatibility of Systems:

1. Provide products and equipment which are compatible with other work requiring mechanical/electrical interface including electrical connections, control devices, water, drain and other piping connections. Verify electrical characteristics, fuel requirements and other interface requirements before ordering equipment and resolve conflicts that may arise.

2. Coordinate equipment, mechanical and electrical work in accordance with the following schedule:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FURNISHED BY</th>
<th>MOUNTED BY</th>
<th>LOW VOLTAGE WIRED BY</th>
<th>POWER WIRED &amp; CONNECTED BY</th>
<th>LOW VOLTAGE CONTROL CONNECTED BY</th>
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<tbody>
<tr>
<td>Equipment motors</td>
<td>I</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>MI</td>
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<tr>
<td>Motor starters, contactors and overload heaters</td>
<td>MI</td>
<td>EI</td>
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<td>MI</td>
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<td>Fused and unfused disconnect switches</td>
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<td>Manual operating switches, speed switches, push-button stations and pilot lights</td>
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<td>Duct detectors</td>
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<td>Control relays and transformers</td>
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<td>Thermostats, time switches*</td>
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<td>Temperature control panels</td>
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<td>Motor and solenoid valves, damper motors, PE and EP switches</td>
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<td>Refrigeration</td>
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<td><strong>equipment, cooling tower and controls</strong></td>
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<td>Electric meters</td>
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</table>

I = Installer of equipment requiring electrical service  
EI = Electrical Installer  
MI = Mechanical Installer  

* Motor driven units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract. However, if the control device does not conduct full load current, then the responsibility shall be that set forth in the above schedule. (Example: a 208 volt, 3-phase, 3-wire motor requires 120 volt control. Electrical Installer shall furnish a 120 volt circuit for control and 208 volt circuit for power and wire the power circuit. Mechanical Installer shall wire the control circuit.)

** Disconnects for AH units are factory mounted.

***Building Service meter provided by Civil. Any sub meter provided by MI. Coordinate meter requirements with utility for remote monitoring by 23 09 00 – Instrumentation and Controls.

H. Special Coordination Requirements for Exterior Envelope Work:

1. **General:** Provide necessary work and services required to coordinate the complete and continuous installation of the building’s heat, air and moisture barriers. Exterior building envelope construction to be coordinated includes, but is not limited to, below-grade walls, slabs-on-grade, exterior opaque walls, windows, curtain walls, roofs, and skylights.

2. **Contract Drawings:**

   a. Drawings indicate general concepts and design intent for continuity of heat, air and moisture barriers at each exterior building envelope component and at transitions between building envelope components. Coordinate details for continuity based on actual product selections and Contractor’s proposed sequence of construction.

I. Complete Systems:

1. It is the intent of the Contract Documents that all systems, including mechanical and electrical, be complete and functional to provide the intended or specified performance. Provide all incidental items and parts necessary to achieve this requirement.

2. Provide correctly sized power, utilities, piping, drains, services and their connections to equipment and systems requiring them, whether or not specific items are listed in the schedule under “Compatibility of Systems” paragraph in this Section.

J. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as University's property.

2. Establish recycling program at job site. Refer to Section 01 74 19 “Construction Waste Management and Disposal” for additional requirements.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to the coordination drawings by multiple subcontractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect/Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings, where required, to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Windows, Curtain Wall, and Exterior Wall Assembly Transition Work: Show all components of each adjacent wall or window system and all required compatible tie-ins between them including transition strips, flashings and sealants. Clearly identify each product, its configuration and its extent. Shop Drawings which only generically indicate adjacent construction and/or indicate “construction by others” will not be acceptable.

10. Review: Architect/Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect/Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect/Engineer will so inform Contractor, who shall make changes as directed and resubmit.

11. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect/Engineer will return RFIs submitted to Architect/Engineer by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect/Engineer.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
   a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Hard copy form or software-generated form with substantially the same content as indicated above, acceptable to Architect/Engineer.
   1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect/Engineer's Action: Architect/Engineer will review each RFI, determine action required, and respond. Allow seven calendar days for Architect/Engineer's response for each RFI. RFIs received by Architect/Engineer after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect/Engineer's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect/Engineer's action may include a request for additional information, in which case Architect/Engineer's time for response will date from time of receipt of additional information.
   3. Architect/Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Contractor-Initiated Change Order Bulletin and Proposal according to Section 01 26 00 "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect/Engineer in writing within seven calendar days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by RFI number. Submit log weekly. Use CSI Log Form 13.2B or Contractor-generated form of substantially same content. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect/Engineer.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect/Engineer's response was received.
F. On receipt of Architect/Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect/Engineer within seven calendar days if Contractor disagrees with response.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify University and Architect/Engineer of scheduled meeting dates and times a minimum of 4 business days prior to meeting.

   a. Participants, including representatives of subcontractors and suppliers, shall be qualified, familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including University and Architect/Engineer, within three business days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time and site convenient to all parties, but no later than 14 calendar days after Notice to Proceed.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:

   a. Authorized representatives of University:

      1) University Project Manager.
      2) AHEC Project Manager.

   b. Architect/Engineer and their consultants.
   c. Contractor’s project manager and superintendent.
   d. Major subcontractors and suppliers.
   e. Other concerned parties shall attend the conference.

3. Agenda: Discuss items of significance that could affect progress, including the following:

   a. Designation of key personnel and their duties.
   b. Lines of communications.
   c. List of major subcontractors and suppliers.
   d. Tentative construction schedule.

      1) Phasing.
      2) Critical work sequencing and long-lead items.
      3) Equipment deliveries and priorities.

   e. Procedures and processing of:

      2) RFI’s
      3) Testing and inspecting.
4) Applications for Payment.
5) Submittals.
6) Preparation of record documents.

f. Use of the premises, existing building and adjacent buildings as applicable.

   1) Work restrictions.
   2) Working hours.
   3) University's occupancy requirements.
   4) Procedures for disruptions and shutdowns.
   5) Construction parking and staging.
   6) Construction route and site access.
   7) Office, work, and storage areas.
   8) Progress cleaning and housekeeping procedures.

g. Project coordination.
h. Distribution of the Contract Documents.
i. Temporary facilities and controls.
j. Indoor Air Quality Plan and Monitoring including procedures for moisture and mold control.
k. Construction waste management and recycling.
l. Safety.

1) Fire and Life Safety.
2) Health and Safety.

m. First aid.
n. Security.
o. Building Department.
p. Telecommunications.
q. Building Services.
r. Building Operations.
s. University Work Related Policies.
t. Contractor Contacts.
u. University Contacts.
v. University Process Forms.

1) Key Request Form.
2) Access Control Badge Application Form.
3) Utility Interruption Request Form.
4) Utility Start-Up Form.
5) Fire Alarm/ Sprinkler Disable Request Form.
6) Hot Work Permit Form.
7) Indoor Air Quality (IAQ) Plan.
8) IAQ Planning Checklist.
9) IAQ Inspection Checklist.
10) Request for Variance.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site for installations, systems or assemblies where required by individual Specification Sections, or where deemed necessary by Contractor.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect/Engineer of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following, as appropriate:
   - Contract Documents.
   - Options.
   - Related RFIs.
   - Related Change Orders.
   - Purchases.
   - Deliveries.
   - Submittals.
   - LEED requirements, for projects pursuing LEED certification.
   - Review of mockups.
   - Possible conflicts.
   - Compatibility requirements.
   - Time schedules.
   - Weather limitations.
   - Manufacturer's written instructions.
   - Warranty requirements.
   - Compatibility of materials.
   - Acceptability of substrates.
   - Temporary facilities and controls.
   - Space and access limitations.
   - Regulations of authorities having jurisdiction.
   - Testing and inspecting requirements.
   - Installation procedures.
   - Coordination with other work.
   - Required performance results.
   - Protection of adjacent work.
   - Protection of construction and personnel.

3. Record significant conference discussions, approved schedules, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information, including University Project Manager and Architect/Engineer.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to University and Architect/Engineer, but no later than 30 calendar days prior to the scheduled date of Substantial Completion or Partial Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:
   - University Project Manager.
   - University Building Maintenance Operations (BMO) Representative.
   - Architect/Engineer and their consultants.
   - Contractor’s project manager and superintendent.
   - Major subcontractors and suppliers.
   - Other concerned parties.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Procedures related to:
   1) Notice of Completion, including preparation of Contractor’s punch list.
   2) Final Inspection.
   3) Notice of Substantial Completion.
   4) Notice of Approval of Occupancy/Use.
   5) Supplemental Occupancy/Use Checklist.
   6) Supplemental Acceptance Checklist.
   7) Pre-acceptance Checklists.
   8) Notice of Acceptance.
   9) Settlement and Final Payment.

b. Preparation of record documents.

c. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

d. Submittal of written warranties.

e. Requirements for completing LEED documentation, for projects pursuing LEED certification.

f. Requirements for preparing operations and maintenance data.

g. Requirements for delivery of material samples, attic stock, and spare parts.

h. Requirements for demonstration and training.

i. University's partial occupancy requirements.

j. Installation of University's furniture, fixtures, and equipment.

k. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:

a. University Project Manager.

b. University Health Safety Department Representative.

c. AHEC Facilities Representative.

d. AHEC Campus Project Manager.

e. Architect/Engineer and their consultants.

f. Contractor’s project manager and superintendent.

g. Major subcontractors and suppliers.

h. Other entities concerned with current progress or involved in planning, coordination, or performance of future activities.

i. As needed, AHEC Campus Representatives.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule:

   1) Review progress since the last meeting.
2) Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule.

3) Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

4) Review schedule for next two week period.

5) Review schedule of deliveries.

6) Review off-site fabrication.

b. Site Safety.

c. Indoor Air Quality Management monitoring.

d. MS4 Storm Water and Water Quality monitoring.

e. Quality:

1) Quality and work standards.

2) Status of correction of deficient items.

3) Progress cleaning.

4) Field observations.

f. Status of submittals.

g. Status of RFIs.

h. Status of Changes including:

1) Change Order Bulletins.

2) Change Order Proposals.

3) Change Orders.

4) Pending claims and disputes.

i. Status of LEED documentation, for projects pursuing LEED certification.

j. Review present and future needs of each entity present including:

1) Access.

2) Site utilization.

3) Temporary facilities and controls.

4) Coordination.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

F. Pay Application and Schedule Review Meeting: Conduct review meeting monthly on or about the 25th of each month.

1. Attendees:

   a. University Project Manager.

   b. Architect/Engineer.

   c. Contractor's Project Manager, Superintendent and Scheduler.

2. Agenda: Review draft pay application and progress schedule update in accordance with the requirements of Section 01 29 00 “Payment Procedures” and Section 01 32 00 “Construction Progress Documentation.”
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00
SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Monthly project status reports.
6. Material location reports.
7. Site condition reports.
8. Special reports.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file and four paper copies.

B. Startup construction schedule (bar chart).
1.5 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date is not permitted. Contract completion date may only be modified by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 21 calendar days, unless specifically allowed by Architect/Engineer.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include adequate time for startup, testing and commissioning.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect/Engineer's administrative procedures necessary for issuing Notice of Substantial Completion.

C. Constraints: Include the following constraints and work restrictions as indicated in the Contract Documents and as applicable in schedule; show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work by University: Include a separate activity for each portion of the Work performed by University.
3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. University-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items, as applicable, on the schedule:

   a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Submittals.
b. Mockups.
c. Fabrication.
d. Sample testing.
e. Deliveries.
f. Installation.
g. Tests and inspections.
h. Building flush-out.
i. Startup and placement into final use and operation.

7. Construction Areas: As applicable, identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Commencement of Work, Substantial Completion, Notice of Occupancy and Use, and Final Acceptance. As applicable, also include milestones for Partial Substantial Completion and Partial Notice of Occupancy and Use.

E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules and as approved by University and Architect/Engineer.

2.2 STARTUP CONSTRUCTION SCHEDULE (BAR CHART)

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven calendar days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 calendar days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
2.3 CONTRACTOR’S CONSTRUCTION SCHEDULE (BAR CHART OR GANTT CHART)

A. Bar-Chart or Gantt-Chart Schedule: Submit startup, horizontal, bar-chart-type or a comprehensive, fully developed, horizontal, Gantt-chart-type construction schedule within 30 calendar days of date established for commencement of the Work. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Use the same breakdown of construction activities as indicated in the Schedule of Values.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar. With each required construction schedule update, place a contrasting mark in each bar to indicate actual completion.

C. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

D. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
10. Dollar value of activity (coordinated with the schedule of values).

E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
5. Changes in the critical path.
6. Changes in total float or slack time.

F. Summary Reports: With each schedule update, at a minimum provide the following hard copy cost and resource reports:

1. Cost report showing activity dollar value, dollar value of work in place to-date and dollar value for current period.
2. Cost report showing activity dollar value, dollar value of work in place to-date, and dollar value for current period summarizing to schedule of values.
3. Resource report showing man-day allocations by specific trade on each activity.
5. Cash flow report showing monthly projections of expenditures.
6. Narrative schedule report documenting:
a. Description of the actual work accomplished during the reporting period.
b. Description of any problem areas.
c. Description of current and anticipated delays with recommended corrective actions to mitigate such delays.
d. A list of proposed modifications, additions, deletions, and changes in logic to the approved construction schedule.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to University within one calendar day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events,
persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise University in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule draft update schedule for discussion and review at monthly project progress schedule and pay application review meeting.

1. Revise schedule immediately after each meeting and issue updated schedule concurrently with submittal of monthly Application for Payment.
2. Include summary reports with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.
4. Schedule updates may change logic but may not change milestone or critical path without prior approval of University and Architect/Engineer.

B. Distribution: Distribute copies of approved schedule to Architect/Engineer University, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00
SECTION 01 32 33  
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.
2. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For photographer.

B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

C. Digital Photographs: Submit image files within three business days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 12 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

   a. Name of Project.
   b. Name and contact information for photographer.
   c. Name of Architect/Engineer.
   d. Name of Contractor.
   e. Date photograph was taken.
   f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
   g. Unique sequential identifier keyed to accompanying key plan.
1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has a camera meeting stated requirements.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to University for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect/Engineer.

D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect/Engineer.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Architect/Engineer-Directed Construction Photographs: From time to time, Architect/Engineer will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect/Engineer will inform photographer of desired vantage points.

1. Do not include date stamp.

H. Additional Photographs: University through Architect/Engineer may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three business days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:
   a. Special events planned at Project site.
   b. Immediate follow-up when on-site events result in construction damage or losses.
   c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
   d. Substantial Completion of a major phase or component of the Work.
   e. Extra record photographs at time of final acceptance.
   f. University's request for special publicity photographs.

END OF SECTION 01 32 33
SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 02 through 33 for additional submittal requirements specific to indicated Specification Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals." Submittals not specifically indicated as informational submittals are considered to be action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals" and include, but are not limited to:

1. Schedules.
2. Permits.
3. Applications for payment.
4. Performance and payment bonds.
5. Insurance certificates.
7. Schedule of Values.
8. Inspection and test results.
SUBMITTAL PROCEDURES

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect/Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule and within 30 calendar days of Notice to Proceed or Commencement of Work, but not later than submittal of first application for payment. Include submittals required during the first 90 calendar days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for Architect/Engineer's final release or approval.
   h. Scheduled date of fabrication.
   i. Scheduled dates for purchasing.
   j. Scheduled dates for installation.
   k. Activity or event numbers.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect/Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect/Engineer for Contractor's use in preparing submittals.
1. Architect/Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
   a. Architect/Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
   b. Digital Drawing Software Program: The Contract Drawings are available in AutoCad version 2012 or later.
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to University and Architect/Engineer.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit for review with sufficient time to avoid construction delays.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect/Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect/Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect/Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
   4. Large and/or Complex Submittals: For large and/or complex submittals, as determined by the Architect/Engineer and for submittals that require sequential reviews by Architect/Engineer's consultants, a review period greater than 14 calendar days may be required. Architect/Engineer and Contractor shall identify such submittals upon submission of the submittal schedule and determine a mutually agreed upon review period.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., LNHS-061000-01). Resubmittals shall include an alphabetic suffix after another dash (e.g., LNHS-061000-01-A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect/Engineer.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to University, containing the following information:

a. Project name.

b. Date.

c. Name and address of Architect/Engineer.

d. Name and address of Contractor.

e. Name of firm or entity that prepared submittal.

f. Names of subcontractor, manufacturer, and supplier.

g. Category and type of submittal.

h. Submittal purpose and description.

i. Specification Section number and title.

j. Specification paragraph number or drawing designation and generic name for each of multiple items.

k. Drawing number and detail references, as appropriate.

l. Location(s) where product is to be installed, as appropriate.

m. Related physical samples submitted directly.

n. Indication of full or partial submittal.

o. Transmittal number.

p. Submittal and transmittal distribution record.

q. Other necessary identification.

r. Contractor's certification that information complies with Contract Document requirements.

s. Remarks.

E. Options: Identify options requiring selection by Architect/Engineer.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect/Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Contractor Certification: On transmittal include Contractor's certification that information complies with Contract Document requirements.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect/Engineer's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect/Engineer's action stamp.

K. Record Documents: Retain complete additional copies of submittals on Project site to be submitted as record documents in accordance with requirements of Section 01 78 39 “Project Record Documents.”

L. Legibility: Provide clear and legible submittals. Submittals that are blurry or are for any reason unreadable will be returned without action.
PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Manufacturer's printed recommendations.
   e. Standard color charts.
   f. Statement of compliance with specified referenced standards.
   g. Statement of compliance with specified trade association standards.
   h. Testing by recognized testing agency.
   i. Application of testing agency labels and seals.
   j. Notation of coordination requirements.
   k. Notation of dimensions verified by field measurement.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Rough-in diagrams and templates indicating clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
7. Submit additional copies of Product Data as required complying with requirements of Section 01 78 39 “Project Record Documents.”

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Highlight, encircle or otherwise indicate deviations from Contract Documents. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect/Engineer’s digital data drawing files is otherwise permitted. Standard information prepared without specific reference to the Project is not considered a shop drawing.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
SUBMITTAL PROCEDURES

University of Colorado Denver
AHEC Tivoli Fit 2 More Classrooms

e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than size of Construction Drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Mount, display or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect/Engineer's Sample.
3. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.
   f. Compliance with recognized standards.
   g. Availability and delivery time.

4. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect/Engineer will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect/Engineer will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
7. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as University's property, are the property of Contractor.

8. Distribution of Samples: Prepare and distribute additional sets to Subcontractors, manufacturers, fabricators, suppliers, Installers, and others as required for performance of the Work. Show distribution on transmittal forms.

9. Field Samples and Mock-Ups: Field Samples and mock-ups specified in individual Sections are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.

E. Selection of Related Materials: Where selections of colors, patterns, textures are specified to be made by Architect/Engineer, assemble complete samples of all specified or approved products for all Specification Sections and submit to Architect/Engineer. Review specifications and assemble all such samples for a combined single submittal. Indicate on the transmittal the latest date for selections to be made for each item to permit delivery of material in accordance with Progress Schedule. Architect/Engineer's action is limited solely to the specified selections or rejection of submittal items not in accordance with Specifications.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect/Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR’S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect/Engineer. Submittals received without Contractor’s substantive review and approval stamp will be rejected and returned to the Contractor.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT/ENGINEER’S ACTION

A. Action Submittals: Architect/Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect/Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect/Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect/Engineer will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect/Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect/Engineer without action.

END OF SECTION 01 33 00
SECTION 01 35 44

SPECIAL PROCEDURES FOR ENVIRONMENTAL HEALTH AND SAFETY AND FIRE AND LIFE SAFETY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special administrative and procedural requirements related to environmental health and safety.

B. Denver Fire is the Authority Having Jurisdiction (AHJ) for Fire and Life Safety. Related Requirements:
   1. Section 01 35 46 “Indoor Air Quality Procedures” for procedure related to maintaining indoor air quality during construction.
   2. Section 02 81 00 “Transportation/Disposal of Hazardous Materials.”

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ENVIRONMENTAL HEALTH AND SAFETY AND FIRE AND LIFE SAFETY PROCEDURES

A. Physical, Life, and Fire Safety:

1. All contractors are required to conform to the Federal Occupational Safety and Health Administration (OSHA) regulations for construction (29 CFR 1926). Certain General Industry Standards (29 CFR 1910) may also apply, depending on location of work.

2. Provide an effective health and safety program to control hazards, including but not limited to compressed gases, welding, electrical, safety netting, cranes, scaffolding and supplies on the roof.

3. Provide fire protection in all construction areas to the satisfaction of the AHEC Campus EHS Manager.

4. During the construction phase, the AHEC Campus EHS Manager may conduct oversight inspections to observe and provide recommendations regarding applicable safety standards. The following minimum items are included:

   a. Do not block exit corridors. Install signage clearly identifying exit routes.
   b. Provide physical barriers with appropriate warning signage to protect public areas from construction work.
   c. Conduct daily inspections to eliminate fire hazards and any other safety hazards.
   d. Periodic safety inspections will be performed on job sites by the Authority Having Jurisdiction. The Authority Having Jurisdiction for fire safety will present Ahec’s Project
Manager with a written summary of the findings who will then take these issues to the Contractor’s superintendent, foreman or other designated representative and return the summary form with documentation of the resolution of safety items to AHEC Campus EHS Manager. Abate deficient items in a timely manner. Include documentation and resolution of safety items presented in weekly Progress Meeting minutes. Inspections by AHEC Campus EHS Manager are spot-checks only. They are not all encompassing. These inspections and recommendations do not relieve the Contractor from obligations related to safe work practices, as required under federal law.

e. AHEC Campus EHS Manager has the right to access the site at all times. Should a potential threat to personnel or property be observed, AHEC Campus EHS Manager may require the hazard related operation immediately altered until adequate safeguards are addressed.

f. Supply AHEC Campus EHS Manager, through the AHEC Project Manager, with a copy of Contractor’s weekly safety meeting minutes and safety inspection reports.

g. Provide adequate number of appropriately rated fire extinguishers to be available on-site for emergency use in the construction area.

h. Insure standpipes, pull stations, electrical panels, water control valves and fire hydrants are accessible at all times.

i. Post emergency notification phone numbers provided by Contractor and AHEC in all construction areas.

j. Notify AHEC Project Manager of any lost time injuries occurring on AHEC’s property within one (1) calendar day and of any fatalities immediately.

k. Submit copies of all injury reports to AHEC Campus EHS Manager, through AHEC’s Project Manager.

l. Equip construction personnel with personal protective equipment (PPE) where required. Coordinate with AHEC Project Manager to identify where use of PPE will be required.

B. OSHA Hazard Communication Standard:

1. Every Contractor and Subcontractor performing work shall comply with the OSHA Hazard Communication Standard. Compliance includes joint University and Contractor responsibilities for the purpose of providing timely communications and information sharing with regard to hazardous materials, chemicals and chemical sources which may be present on-site or brought in by Contractor.

2. AHEC Project Manager will provide Contractor with the following:

a. Information regarding known hazardous chemicals and agents or other hazards present at the job site.

b. AHEC emergency procedures and contact numbers.

3. Provide safety training and environmental surveillance of all workers.

4. Inform and provide V’s Project Manager the following:

a. Material safety data sheets (MSDS) for all chemicals introduced into the workplace.

b. Information regarding potential sources of pollutants which may be entrained in AHEC’s air intakes, e.g., roofing tar fumes, nuisance dusts, exhaust from internal combustion engines, welding or cutting fumes, and asbestos - if damaged or encountered during the course of the work.

C. Asbestos and Lead Paint:

1. The presence of asbestos-containing materials and/or paint containing lead on the job site does not mean a problem exists. Areas where asbestos is friable and not contained or lead paint is present or will be caused to be present in airborne or settled dust are of concern.

2. Responsibilities of AHEC and Contractor regarding asbestos and lead paint are as follows:
a. AHEC:

1) Notify the Contractor of the condition and location(s) where asbestos is known to be present or may reasonably be encountered, e.g., asbestos insulation, ceiling tiles, floor tiles, fire doors, wall and ceiling plasters, concrete, grouting, etc., and lead paint on metal building materials, walls, windows, etc.
2) Coordinate with Contractor when response action is required by a Subcontractor.
3) Contract with third party contractor to monitor areas where friable asbestos and/or lead-containing particles are present during construction/renovation projects for its own records and purpose. Monitoring results can be shared with Contractors but are in no way to be used for Contractor employee monitoring.
4) Final authority on all asbestos-related concerns and contractual arrangements.

b. Contractor:

1) Notify AHEC’s Project Manager of any suspected or existing problem involving asbestos or lead and cease work in that area until AHEC has assessed the situation.
2) Ensure that undamaged asbestos-containing material and/or material containing lead, not included in the scope of the project, are not damaged.
3) Train and monitor their own employees, including Asbestos Awareness training and Lead Paint Awareness training, where applicable.
4) Be responsible for all environmental/industrial hygiene surveillance of its work staff and subcontractors and for required area monitoring where potential contamination of adjacent areas exists.
5) Prevent problems which can result in asbestos or lead exposure to building occupants.
6) Coordinate with the AHEC Campus EHS Manager and Building Maintenance and Operations through AHEC’s Project Manager and perform all activities that may potentially disturb asbestos containing materials in a manner acceptable to the EHS.
7) Follow State of Colorado regulation, Emission Standards for Asbestos, Part B, Control of Asbestos, “Regulation 8” and OSHA standards regulating exposure to asbestos and lead.
8) Where applicable, comply with Section 02 81 00 “Transportation/Disposal of Hazardous Materials.”

D. Carcinogens:

1. Contractor or any Subcontractor shall not knowingly install or cause to be installed any material or product containing carcinogens. Refer to Annual Report on Carcinogens, U.S. Department of Health and Human Services, National toxicology Program.

E. Hazardous Waste:

1. All hazardous wastes are to be handled and disposed of according to current AHEC Campus EHS guidelines which can be obtained through AHEC Project Manager. Only individuals specifically authorized by AHEC may sign hazardous waste manifests for wastes generated on AHEC’s property. Only AHEC approved transporters and disposal facilities are to be used for transportation and disposal of hazardous wastes.

F. The Control of Hazardous Energy (Lockout/Tagout):

1. Provide and enforce a program and procedures for the control of hazardous energy (lockout/tagout) including, but not limited to, locks, tags and lockout devices. Provide proof that workers have received safety training in the control of hazardous energy through lockout/tagout.
G. Hot Work Operations:

1. Comply with AHEC hot work policy and obtain Hot Work Permit prior to executing any hot work in existing buildings.
2. Notify AHEC Project Manager prior to any hot work on AHEC property.
3. Provide and enforce a program to control fires during hot work operations. Provide appropriately rated fire extinguishers, fire retardant protective covers (when needed), and any other hot work related equipment.

H. Confined Space Entry:

1. Work in compliance with the “Confined Spaced Entry Procedure for Non-AHEC Personnel” whenever any project requires entry into a confined space. A copy of this procedure can be obtained from AHEC Campus EHS Manager through AHEC’s Project Manager.

I. Green Tagging of Work Area:

1. Obtain a Green Tag and Construction Permit from the AHEC Project Manager prior to any work being conducted in a laboratory or on any exhaust ductwork system serving a laboratory. If a Green Tag has been issued, it will be displayed at the entry of the laboratory area. The Green Tag assures that any radioactive, chemical or biological materials have been removed from the laboratory verifying the area is free from hazards to workers. If a Green Tag is not displayed, coordinate tagging with EHS through AHEC’s Project Manager.

END OF SECTION 01 35 44
SECTION 01 35 46
INDOOR AIR QUALITY PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for managing emissions and moisture control during construction.

1.3 DEFINITIONS

A. Sustainable Design Related Terminology: As defined is ASTM E 2114.

B. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.

C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.

1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.

E. Interior Final Finishes: Materials and products that will be exposed at interior, occupied spaces including but not limited to flooring, wallcovering, finish carpentry, and ceilings.

F. Packaged Dry Products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging including but not limited to carpets, resilient flooring, ceiling tiles, and insulation.

G. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.
1.4 QUALITY ASSURANCE

A. Inspection and Testing Lab Qualifications: Minimum of 5 years experience in performing the types of testing specified herein.

1.5 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with University and Architect/Engineer to review and discuss the proposed IAQ Management Plan and develop a mutual understanding of detailed requirements for maintaining indoor air quality and environmental protection.

1.6 SUBMITTALS

A. Indoor Air Quality (IAQ) Management Plan: Not less than 10 business days before the Pre-construction meeting, prepare and submit an IAQ Management Plan including, but not limited to, the following:

1. Procedures for control of emissions during construction.
   a. Identify schedule for application of interior finishes.

2. Procedures for moisture control during construction.
   a. Identify porous materials and absorptive materials.
   b. Identify schedule for inspection of stored and installed absorptive materials.

3. Revise and resubmit Plan as required by University.
   a. Approval of Contractor’s Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

B. Product Data:

1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
2. Submit air pressure difference maps for each mode of operation of HVAC.
3. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products. Coordinate with Section 01 78 23 – Operation and Maintenance Data.
   a. Adhesives.
   b. Floor and wall patching/leveling materials.
   c. Caulking and sealants.
   d. Insulating materials.
   e. Fireproofing and firestopping.
   f. Carpet.
   g. Paint.
   h. Clear finish for wood surfaces.
   i. Lubricants.
   j. Cleaning products.

C. Inspection and Test Reports:

1. Moisture control inspections.
2. Moisture content testing.
3. Moisture penetration testing.
4. Microbial growth testing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 IAQ MANAGEMENT - EMISSIONS CONTROL

A. Provide point person responsible for the implementation and assurance that the Indoor Air Quality Plan is being implemented.

B. University Indoor Air Quality Plan: Comply with the requirements of the University IAQ Plan, latest version, appended to this Specification Section.

C. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

3.2 IAQ MANAGEMENT - MOISTURE CONTROL

A. Housekeeping:

1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.

B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.

1. Examine materials for dampness as they arrive. If acceptable to University, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect weekly.
   a. Where stored on-site or installed absorptive materials become wet, notify Architect/Engineer and University. Inspect for damage. If acceptable to University, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
4. Basement: Monitor basement and crawlspace humidity, and dehumidify when relative humidity is greater than 85 percent for more than 2 weeks or at the first sign of mold growth.
5. Site drainage: Verify that final grades of site work and landscaping drain surface water and ground water away from the building.
6. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
a. Air and weather-resistive barrier: Verify air and weather-resistive barrier is installed without punctures and/or other damage. Verify air barrier and weather-resistive is sealed completely.
b. Flashing: Verify correct shingling of the flashing for roof, walls, windows, doors, and other penetrations.
c. Insulation layer: Verify insulation is installed without voids.
d. Roofing: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair

7. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
8. HVAC: Inspect HVAC system as specified in Section 23 08 00 – Commissioning.
   
   a. And, inspect HVAC to verify:
      1) Condensate pans are sloped and plumbed correctly.
      2) Access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils.
      3) Ductwork and return plenums are air sealed.
      4) Duct insulation is installed and sealed.
      5) Chilled water line and refrigerant line insulation are installed and sealed.

C. Schedule:

1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air and weather-resistive barriers, flashing, exterior sealants and roofing, at the earliest possible time.

D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure that they are dry before sealing them into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.

1. Concrete: Moisture test prior to finish flooring application as specified in Division 09.
2. Wood: Moisture test as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are < 20% at center of piece; < 15% at surface.
3. Gypsum Board, Gypsum Plaster, Insulation, and other absorptive materials: Moisture test with a Pinless Moisture Meter to assess patterns of moisture, if any.

E. Testing for Moisture Penetration:

1. Windows: Test as per ASTM E1105 Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference at 100 percent static-air-pressure difference specified in applicable Division 08 Sections; unless otherwise indicated, acceptable upper limits are no leakage for 15 minutes.
   
   a. Number of Tests: 1 percent of openings but not less than two.
2. Horizontal Waterproofing (not roofing): Test as per ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are no leakage for 15 minutes.
   a. Test frequency: 100 percent of horizontal waterproofed surfaces.

3. Masonry: Test as per ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are no leakage for 15 minutes.

4. Exterior Walls:
   a. Air tightness of the enclosure test: ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or ASTM E1827
      1) Air Leakage: The mean value of the air leakage flow rate calculated from measured data at 0.3 in wg (75 Pa) must not exceed 0.25 cu ft/minute per square foot of envelope area. Measurements must be referenced at standard conditions of 14.696 psi (101.325 KPa) and 68 deg F.

F. Testing for Support of Microbial Growth: Test and report in accordance with ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers. Indicate susceptibility of product or material to colonization and amplification of microorganisms. Identify microorganisms and conditions of testing.

1. Normal conditions: Perform testing at 35 degrees Centigrade and 50 percent relative humidity.
2. Extreme conditions: Perform worst case scenarios screening tests by providing an atmosphere where environmental conditions may be favorable for microbial growth.
3. Perform testing for the following:
   a. Fireproofing material on appropriate substrate.
   b. Ceiling tile.
   c. Wall covering.
   d. Other appropriate material.

END OF SECTION 01 35 46
Indoor Air Quality Plan
August 5, 2016

Project

Completed by: 
(Name & Company)

Date: 

This plan describes the measures to be taken to provide good indoor air quality (IAQ) during construction and after construction is complete and the occupants have moved into the building. This plan is based on the SMACNA standard “IAQ Guidelines for Occupied Buildings under Construction” and the requirements of the LEED.

It is not the intent of this document to replace or supersede OSHA regulations as to safe construction workplace practices. It remains the responsibility of the Construction Manager and the individual sub-contractors to maintain safe building and site operations. Additional precautions may be necessary when hazardous materials are present.

The plan will address construction IAQ by recommending procedures in five areas of concern, which in turn will allow the building to achieve two LEED program points:

- HVAC system protection
- Containment source control
- Pathway interruption
- Housekeeping
- Scheduling

The following describes the specific measures to be performed in each area of concern:

1. HVAC Protection

- During construction, provide MERV 13 filters for supply air intake when in use. Provide MERV 8 filters at the return air system openings when in use. Perform frequent maintenance when the HVAC system is being utilized and replace filters as they become loaded, prior to building flushout, and prior to occupancy.
- When performing construction activities that produce dust, such as drywall sanding, concrete cutting, masonry work, wood sawing or adding insulation, seal off the supply diffusers and return air system openings completely for the duration of the task.
- Shut down and seal off the supply diffusers and return air ducts during any demolition operations.
- Whenever the HVAC system is not used during construction, seal off the supply diffusers and return air system openings to prevent the accumulation of dust and debris in the duct system.
- Do not use the mechanical rooms to store construction or waste materials. Keep rooms clean and neat.
- Provide periodic duct inspections during construction; if the ducts become contaminated due to inadequate protection, clean the ducts professionally in accordance with NADCA (National Air Duct Cleaning Association) standards.
- The General Contractor shall take photographs showing measures in place.

2. Source Control

- Use low VOC products as indicated by the specifications to reduce potential problems.
- Restrict traffic volume and prohibit idling of motor vehicles where emissions could be drawn into the building.
- Utilize electric or natural gas alternatives for gasoline and diesel equipment where possible and practical. Use low-sulfur diesel in lieu of regular diesel.
• Cycle equipment off when not being used or needed.
• Exhaust pollution sources to the outside with portable fan systems. Prevent exhaust from recirculating back into the building from construction equipment outside the building.
• Keep containers of wet products closed as much as possible. Cover or seal containers of waste materials that can release odor or dust.
• Protect stored on-site or installed absorptive building materials from weather and moisture; wrap with plastic and seal tight to prevent moisture absorption.
• The General Contractor shall take photographs showing measures in place.

3. Pathway Interruption

• Provide dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable.
• Locate pollutant sources as far away as possible from supply ducts and areas occupied by workers when feasible. Supply and exhaust systems may have to be shut down or isolated during such activity.
• During construction, isolate areas of work to prevent contamination of clean or occupied areas. Pressure differentials may be utilized to prevent contaminated air from entering clean areas.
• Depending on weather, ventilation using 100% outside air will be used to exhaust contaminated air directly to the outside during installation of VOC emitting materials.

4. Housekeeping

• Provide regular cleaning concentrating on HVAC equipment and building spaces to remove contaminants from the building prior to occupancy.
• All coils, air filters, fans and ductwork shall remain clean during installation and, if required, will be cleaned prior to performing the testing, adjusting and balancing of the systems.
• Suppress and minimize dust with wetting agents or sweeping compounds. Utilize efficient and effective dust collecting methods such as a damp cloth, wet mop, or vacuum with particulate filters, or wet scrubber.
• Remove accumulations of water inside the building. Protect porous materials such as insulation and ceiling tile from exposure to moisture.
• Thoroughly clean all interior surfaces prior to replacing filters and running HVAC system for system balancing, commissioning and building flushout.
• Provide photographs of the above activities during construction to document compliance.

5. Scheduling and Construction Activity Sequence

• Schedule high pollution activities that utilize high VOC level products (including paints, sealers, insulation, adhesives, caulking and cleaners) to take place prior to installing highly absorbent materials (such as ceiling tiles, gypsum wall board, fabric furnishings, carpet and insulation, for example). These materials will act as ‘sinks’ for VOCs, odors and other contaminants, and release them later after occupancy.

PLANNING AND INSPECTION CHECKLISTS

The planning and inspection checklists included in this document are useful to ensure construction IAQ management is planned and implemented correctly. The planning checklist should be completed by the contractor prior to construction. The inspection checklists should be completed monthly to confirm the IAQ management plan is being followed. At the time of inspection, photographs should be taken to support the checklist and to provide audit documentation for the USGBC.
Project: ________________________________________________________________
Completed by: __________________________________________________________
(Name & Company)
Date: ________________________________

1. HVAC Protection
   - MERV 13 filters at supply air intake
   - MERV 8 filters at return air openings
   - Seal supply diffusers and return air during demolition
   - Seal supply diffusers and return air openings during construction
   - Mechanical rooms clean and neat
   - Periodic duct inspections during construction
   - General Contractor to document with photographs

2. Source Control
   - Low/no VOC products as indicated by specifications
   - Restrict vehicle traffic volume and prohibit idling
   - Utilize electric or natural gas alternatives for gasoline and diesel
   - Cycle equipment off when not being used or needed
   - Exhaust pollution sources to the outside
   - Keep containers of wet products closed
   - Cover or seal containers of waste materials
   - Protect absorptive building materials from weather and moisture
   - Prevent fume migration from construction vehicles and equipment into adjacent buildings
   - General Contractor to document with photographs

3. Pathway Interruption
   - Provide dust curtains or temporary enclosures
   - Locate pollutant sources as far away as possible from supply dusts and areas occupied by workers
   - General Contractor to document with photographs
   - Isolate areas of work to prevent contamination of clean or occupied areas
   - When using VOC emitting materials ventilate using 100% outside air
General Contractor to document with photographs

4. **Housekeeping**
   - Provide regular cleaning, including HVAC equipment
   - If necessary clean HVAC equipment prior to testing, adjusting and balancing the systems
   - Suppress and minimize dust with wetting agents or sweeping compounds
   - Remove accumulations of water inside the building
   - Protect porous materials
   - General Contractor to document with photographs

5. **Scheduling and Construction Activity Sequence**
   - Schedule high pollution activities prior to installing absorbent materials
   - General Contractor to document with photographs

I confirm the checked activities to be proceeding according to the Construction Indoor Air Quality Plan. Items that are not checked will be addressed, initialed and dated once corrective actions have been taken. Items that are not applicable are labeled as such.

Signed: ____________________________ Date: ________________

(Contractor)
University of Colorado Denver IAQ
February 14, 2009

Inspection Checklist
(Must be completed weekly)

Project: ________________________________________________________________

Completed by: __________________________________________________________
(Name & Company)

Date: _________________________________________________________________

1. HVAC Protection
   - MERV 13 filters at supply air intake
   - MERV 8 filters at return air openings
   - Seal supply diffusers and return air during demolition
   - Seal supply diffusers and return air openings during construction
   - Mechanical rooms clean and neat
   - Periodic duct inspections during construction
   - General Contractor to document with photographs

2. Source Control
   - Low/no VOC products as indicated by specifications
   - Restrict vehicle traffic volume and prohibit idling
   - Utilize electric or natural gas alternatives for gasoline and diesel
   - Cycle equipment off when not being used or needed
   - Exhaust pollution sources to the outside
   - Keep containers of wet products closed
   - Cover or seal containers of waste materials
   - Protect absorptive building materials from weather and moisture
   - General Contractor to document with photographs

3. Pathway Interruption
   - Provide dust curtains or temporary enclosures
   - Locate pollutant sources as far away as possible from supply dusts
     and areas occupied by workers
   - General Contractor to document with photographs
   - Isolate areas of work to prevent contamination of clean or occupied areas
   - When using VOC emitting materials ventilate using 100% outside air
   - General Contractor to document with photographs

4. Housekeeping
☐ Provide regular cleaning, including HVAC equipment
☐ If necessary clean HVAC equipment prior to testing, adjusting and balancing the systems
☐ Suppress and minimize dust with wetting agents or sweeping compounds
☐ Remove accumulations of water inside the building
☐ Protect porous materials
☐ General Contractor to document with photographs

5. **Scheduling and Construction Activity Sequence**
   - ☐ Schedule high pollution activities prior to installing absorbent materials
   - ☐ General Contractor to document with photographs

I confirm the checked activities to be proceeding according to the Construction Indoor Air Quality Plan. Items that are not checked will be addressed, initialed and dated once corrective actions have been taken. Items that are not applicable are labeled as such.

Signed: ______________________________________________

Date: _________________

(Contractor)
SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for quality assurance and quality control.
B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect/Engineer, University, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.
C. Related Requirements:
   1. Section 01 42 00 "Reference" for list of references, standards and definitions.
   2. Section 01 91 13 “General Commissioning” for coordination of testing with commissioning activities.
   3. Division 23 for testing, adjusting and balancing of mechanical systems.
   4. Division 26 for testing of electrical systems.

1.3 DEFINITIONS
A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect/Engineer.
C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities
of materials and execution; to review coordination, testing, or operation; to show interface between
dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are
not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work
will be judged.

1. As indicated in individual Specifications Sections or on the Drawings, the Work may include the
following types of mockups:

   a. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify
      performance characteristics.

   b. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from
      the building but on Project site, consisting of multiple products, assemblies, and
      subassemblies.

   c. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling
      finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and
      lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and
   materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency
   qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product
   performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill,
   factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the
   Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory
   shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee,
   Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including
   installation, erection, application, and similar operations.

   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain
      construction activities be performed by accredited or unionized individuals, or that requirements
      specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully
   completed a minimum of five previous projects similar in nature, size, and extent to this Project; being
   familiar with special requirements indicated; and having complied with requirements of authorities
   having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish
different or conflicting requirements for minimum quantities or quality levels, comply with the most
stringent requirement. Refer conflicting requirements that are different, but apparently equal, to
Architect/Engineer for a decision before proceeding.
B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect/Engineer for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect/Engineer.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.
B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For University's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

1. Monitor quality control over products, services, site conditions, and workmanship to produce work of specified quality.
2. Comply fully with manufacturers' instructions, including each step in sequence.
3. If manufacturers' instructions conflict with Contract Document requirements, request clarification from Architect/Engineer before proceeding.
4. 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.
5. Perform work by persons qualified to produce workmanship of specified quality.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
D. Subcontractor and Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance. In addition, comply with the following:

1. For all trades: Proof of applicable licensing.
2. Electrical contractors:

3. Plumbing Contractors:
   c. Gas piping installations: State of Colorado master plumber with minimum 5 years institutional or heavy commercial gas piping experience. Provide an on-site supervisor with a minimum of 3 years of supervisory experience.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 or ASTM D 3740 as appropriate; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST’s National Voluntary Laboratory Accreditation Program.
4. Authorized to operate in the State of Colorado.
5. Calibrate testing equipment at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or of accepted values of natural physical constants.

H. Manufacturer’s Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
   
a. Provide test specimens representative of proposed products and construction.
   
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   
d. When required, build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   
e. When required, build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups, as applicable; do not reuse products on Project.
   
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect/Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   
K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect/Engineer.
2. Notify Architect/Engineer seven calendar days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect/Engineer’s approval of mockups before starting work, fabrication, or construction.
   
a. Allow seven calendar days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: When indicated on Drawings, construct integrated exterior mockup. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

M. Room Mockups: When indicated on Drawings, construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect/Engineer to evaluate quality of the Work. Provide room mockups of the following rooms:

N. Laboratory Mockups: When required by individual Specification Sections, comply with requirements of preconstruction testing and those specified in individual Specification Sections.
1.8 QUALITY CONTROL

A. University Responsibilities: Where quality-control services are indicated as University's responsibility, University will engage a qualified testing agency to perform these services.

1. University will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made by the University.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to University are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by University, unless agreed to in writing by University.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.


1. Notify Architect/Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples including, but not limited to, safe storage and proper curing of concrete test cylinders at Project site for first 24 hours after casting as required by ASTM C 31.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Manufactured Items and Equipment: Where manufactured products or equipment are required to have representative samples tested, do not use such materials or equipment until tests have been made and the materials or equipment found to be acceptable. Do not incorporate in the work any product which becomes unfit for use after acceptance.

J. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to University, Architect/Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: University will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of University, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect/Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect/Engineer with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections including instructions received from University. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect/Engineer.
4. Identification of testing agency or special inspector conducting test or inspection.
5. Disposition: Pass, fail, nature of defects, if any.
6. Date and descriptions of remedial or correction action taken.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect/Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.3 SCHEDULE OF INSPECTIONS AND TESTS BY UNIVERSITY

A. University will engage testing agency and pay for testing and inspection associated with the following materials and systems, where included in the Project:

1. Compaction density of fill and backfill.
2. Drilled pier end bearing conditions and depths.
4. Precast concrete.
5. Post-tensioned concrete tendons.
7. Structural steel field welds and bolted connections.
8. Spray-applied fireproofing.
10. Asphaltic concrete paving.
11. Foundation drainage systems.
12. Drainage structures and piping.
15. Fluid applied membranes.
16. Thermal imaging.
17. Curtain wall, window, and door field testing.
18. Ceiling hanger wire pull-out.
20. Field sound testing of operable partitions.
22. Fan vibration.

END OF SECTION 01 40 00
SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building Department Authority.
2. MS 4 Storm Water and Water Quality Permits
3. Applicable Codes and Standards.

1.3 BUILDING DEPARTMENT AUTHORITY

A. A.H.E.C. and the State of Colorado are charged with the responsibility of ensuring that provision of applicable codes, standards and guidelines are met on its campuses.

B. A.H.E.C. has an established relationship with C-West code consultants as being responsible to review and examine buildings and plan documents, to permit and inspect construction and/or demolition to ensure conformance to codes adopted by the University and issue certificates of temporary occupancy and occupancy if satisfactory conformance is demonstrated.

C. Permits: Obtain a building permit for the Project from C-West Consultants. Prior to erecting, constructing, enlarging, repairing, moving, removing, converting or demolishing any building or portion thereof. Coordinate and obtain all permits through the University Project Manager. The Contractor is not responsible for costs associated with construction permits.

1. Exempt work: A building permit is not required for the following:

a. Fences less than or equal to 6 feet tall.
b. Movable casework, counters and partitions not over 5 feet 9 inches tall with no electrical or plumbing.
c. Platforms, walks, and driveways not more than 30 inches above grade and not over any basement or story below.
d. Painting, papering and similar finish work.
e. Other work of limited scope at the discretion of the CBO.

D. Permit Issuance: The CBO, or at the discretion of the CBO a third party code consultant, will review application, Drawings, Specifications, computations and other data filed for permit. Complete the permit application with the University Project Manager. Permits require submittal of two (2) stamped, signed sets of Construction Documents, including Drawings, Specifications and all Addenda, and one (1) set of each engineering discipline’s calculations, where such calculations are required. If CBO determines that submittal conforms to the requirements of the Building Code and other applicable codes, standards, laws,
regulations and ordinances, an inspection record card will be issued with the building permit. Keep one stamped set of documents on site. The University will keep one stamped set in the Campus Support plan room.

E. Suspension or Revocation of Permit: CBO may, in writing, suspend or revoke a permit issued in error or on the basis of submitted information that is incorrect or that is in violation of the Building Code and other applicable codes and standards.

F. Posting of Permit: Post the Permit in a visible and protected location near the access to the project.

G. Inspection Record Card: Post the Inspection Record Card next to the permit in a visible and protected location near the access to the project. CBO will make required entries based on inspection of the work.

H. Inspection Requests:

1. Notify C-West or State electrical/plumbing inspector that work is ready for inspection two business days before such inspection is desired by telephoning the number posted on the permit. The CBO retains the right to require requests in writing.

2. A re-inspection fee may be charged for prior rejected items.

I. Construction Inspections:

1. Contractor is not responsible for costs associated with construction inspections, except re-inspections. The CBO or his/her designee will perform all general building, electrical and plumbing inspections. All construction or work for which a permit is required must remain accessible and exposed for inspection purposes. Provide access to and means for inspection of work.

2. Site Utilities: Water, Sanitary, and Storm Utilities: Contact and comply with all requirements of the City of Denver.

3. Plumbing and Electrical Inspections: For new buildings and major additions, contact and comply with all requirements of State of Colorado Plumbing and Electrical Boards.

4. Provisions for structural and other special inspections required by Contract Documents, current approved State Building Codes will be provided by the University.

J. Certification of Occupancy:

1. When CBO inspects the project and finds no violations of any provision of the Building Code, other applicable codes, standards, laws, regulations and ordinances, CBO will issue a Certification of Occupancy (CO) which will contain the following:

   a. Building permit number.
   b. Address of building.
   c. Name and address of Owner.
   d. Description of building or portion thereof for which certification is issued.
   e. Statement that described building or portion thereof has been inspected for compliance with the requirements of the Building Code, other applicable codes, standards, laws, regulations and ordinances, as relates to type of occupancy and use for which the building is intended.

2. Temporary Certificate of Occupancy (TCO): If CBO finds no substantial hazard will result from occupancy of any building or portion thereof before the same is completed, CBO may issue a TCO
for the use of a portion or portions of a building or structure prior to the completion of the entire building or structure.

3. Occupancies are only allowed after the A/E prepares a Notice of Partial Substantial Completion and a Notice of Approval of Occupancy /Use and the documents are signed by the A/E, University and the State Buildings Delegate.

1.4 APPLICABLE CODES AND STANDARDS

A. The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects. Current applicable codes can be obtained from The Office of the State Architect’s website.

B. University of Colorado Denver Codes and Standards: The following codes and standards supplement those indicated on the Office of the State Architect website.


   a. Use the most restrictive interpretation where NFPA 101 conflicts with the IBC requirements.


17. OSHA “Safety and Health Regulation for Construction” (29 CFR 1926).
18. OSHA “Occupational Safety and Health Standards” (29 CRF 1910).
20. CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL); latest edition.
28. For Asphalt and Paving 2011 CDOT Standards and Specifications for Road and Bridge Construction shall apply.

C. Other Standards: As indicated in individual Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 41 00
SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Definitions.
2. Industry Standards.
3. Abbreviations and Acronyms.

B. Related Requirements:

1. Section 01 10 00 “Summary” for an explanation of specification and drawing conventions.
2. Section 01 41 00 “Regulatory Requirements” for a list of applicable codes.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

1. Definitions in this Section are not intended to be complete, exhaustive or exclusive. They are general and apply to the Work to the extent that such definitions are not stated more explicitly in other provisions of the Contract Documents.

B. "Approved": When used to convey Architect/Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect/Engineer's duties and responsibilities as stated in the Conditions of the Contract. Except where expressly indicated, such approval does not release the Contractor from responsibility to fulfill requirements of the Contract Documents.

C. “Backup”: N+1 system.

D. "Directed": A command or instruction by Architect/Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

E. “EHS”: Environmental Health and Safety.

F. “Engineer”: Architect/Engineer. Other terms including “Mechanical Engineer”, “Electrical Engineer”, or “Structural Engineer” have the same meaning as “Engineer.”

G. “General Conditions”: Contract terms contained Construction Manager/General Contractor Agreement CMGC, State Form SC-6.4 “General Requirements”: Provisions and requirements of all Division 01 Sections as they apply to all aspects of the Work.
H. "Guarantee": The narrow definition of the term “warranty” applying to both “warranty” and “guarantee” which terms are used interchangeably.

I. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

J. "Redundant": 2N system. The level of redundancy is determined by design.

K. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

L. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

M. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

N. "Owner": Principal Representative and/or University.

O. "Provide": Furnish and install, complete and ready for the intended use.

P. “Project Manual”: Bound, printed volume or volumes including Conditions of the Contract and Specifications, which may also include bidding requirements, contract forms, details, schedules, surveys, reports or other relevant items that may or may not be Contract Documents.

Q. "Project Site": Space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

R. “Supplementary Conditions”: University Special Supplementary General Conditions. Other terms including “Supplementary General Conditions” shall have the same meaning.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

1. Referenced standards take precedence over standards that are not referenced but generally recognized in the construction industry as applicable.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents.

1. Updated Codes and Standards: Where an applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected, submit Contractor-Initiated Change Order Bulletin and Change Order Proposal in accordance with Section 01 26 00 “Contract Modification Procedures” for consideration to modify contract requirements to comply with revised code or standard.
C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
2. Where required by individual Specification Sections provide and maintain copies of referenced codes and standards at Project Site.
3. Although copies of standards needed for enforcement of requirements may be part of required submittals, the Architect/Engineer reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.

D. Unreferenced Standards: Unreferenced standards are not directly applicable to the Work, except as a general requirement of whether the Work complies with recognized construction industry standards.

E. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AABC  Associated Air Balance Council  (202) 737-0202
       www.aabc.com

AAMA  American Architectural Manufacturers Association  (847) 303-5664
       www.aamanet.org

AASHTO American Association of State Highway and Transportation Officials  (202) 624-5800
       www.transportation.org

AATCC American Association of Textile Chemists and Colorists  (919) 549-8141
       www.aatcc.org

ABMA American Bearing Manufacturers Association  (202) 367-1155
       www.americanbearings.org

ACI American Concrete Institute  (Formerly: ACI International)  (248) 848-3700
       www.concrete.org

ACPA American Concrete Pipe Association  (972) 506-7216
       www.concrete-pipe.org

AEIC Association of Edison Illuminating Companies, Inc. (The)  (205) 257-2530
       www.aeic.org

AF&PA American Forest & Paper Association  (800) 878-8878
<table>
<thead>
<tr>
<th>Organization</th>
<th>URL</th>
<th>Phone</th>
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<tbody>
<tr>
<td>AGA</td>
<td>American Gas Association</td>
<td>(202) 824-7000</td>
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<td></td>
<td><a href="http://www.aga.org">www.aga.org</a></td>
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<tr>
<td>AHAM</td>
<td>Association of Home Appliance Manufacturers</td>
<td>(202) 872-5955</td>
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<td></td>
<td><a href="http://www.aham.org">www.aham.org</a></td>
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<tr>
<td>AHRI</td>
<td>Air-Conditioning, Heating, and Refrigeration Institute (The)</td>
<td>(703) 524-8800</td>
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<td><a href="http://www.ahrinet.org">www.ahrinet.org</a></td>
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<tr>
<td>AI</td>
<td>Asphalt Institute</td>
<td>(859) 288-4960</td>
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<td><a href="http://www.asphaltinstitute.org">www.asphaltinstitute.org</a></td>
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<td>AIA</td>
<td>American Institute of Architects (The)</td>
<td>(800) 242-3837</td>
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<td><a href="http://www.aia.org">www.aia.org</a></td>
<td>(202) 626-7300</td>
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<td>AISC</td>
<td>American Institute of Steel Construction</td>
<td>(800) 644-2400</td>
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<td></td>
<td><a href="http://www.aisc.org">www.aisc.org</a></td>
<td>(312) 670-2400</td>
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<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
<td>(202) 452-7100</td>
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<td></td>
<td><a href="http://www.steel.org">www.steel.org</a></td>
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<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
<td>(303) 792-9559</td>
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<td><a href="http://www.aitec-glulam.org">www.aitec-glulam.org</a></td>
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<tr>
<td>AMCA</td>
<td>Air Movement and Control Association International, Inc.</td>
<td>(847) 394-0150</td>
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<td><a href="http://www.amca.org">www.amca.org</a></td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
<td>(202) 293-8020</td>
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<td></td>
<td>wwwansi.org</td>
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<td>AOSA</td>
<td>Association of Official Seed Analysts, Inc.</td>
<td>(607) 256-3313</td>
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<td><a href="http://www.aosaseed.com">www.aosaseed.com</a></td>
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<tr>
<td>APA</td>
<td>APA - The Engineered Wood Association</td>
<td>(253) 565-6600</td>
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<td><a href="http://www.apawood.org">www.apawood.org</a></td>
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<tr>
<td>APA</td>
<td>Architectural Precast Association</td>
<td>(239) 454-6989</td>
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<td><a href="http://www.archprecast.org">www.archprecast.org</a></td>
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<td>API</td>
<td>American Petroleum Institute</td>
<td>(202) 682-8000</td>
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<td><a href="http://www.api.org">www.api.org</a></td>
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<td>ARI</td>
<td>Air-Conditioning &amp; Refrigeration Institute (See AHRI)</td>
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<td>ARI</td>
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<td>(See AHRI)</td>
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<td>ARMA</td>
<td>Asphalt Roofing Manufacturers Association</td>
<td>(202) 207-0917</td>
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<td><a href="http://www.asphaltroofing.org">www.asphaltroofing.org</a></td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
<td>(800) 548-2723</td>
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<td><a href="http://www.asce.org">www.asce.org</a></td>
<td>(703) 295-6300</td>
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ASCE/SEI  American Society of Civil Engineers/Structural Engineering Institute
(See ASCE)  
ASHRAE  American Society of Heating, Refrigerating and Air-Conditioning Engineers
www.ashrae.org  
ASME  ASME International
(American Society of Mechanical Engineers)
www.asme.org  
ASSE  American Society of Safety Engineers (The)
www.asse.org  
ASSE  American Society of Sanitary Engineering
www.asse-plumbing.org  
ASTM  ASTM International
(American Society for Testing and Materials International)
www.astm.org  
ATIS  Alliance for Telecommunications Industry Solutions
www.atis.org  
AWEA  American Wind Energy Association
www.awea.org  
AWI  Architectural Woodwork Institute
www.awinet.org  
AWMAC  Architectural Woodwork Manufacturers Association of Canada
www.awmac.com  
AWPA  American Wood Protection Association
(Formerly: American Wood-Preservers' Association)
www.awpa.com  
AWS  American Welding Society
www.aws.org  
AWWA  American Water Works Association
www.awwa.org  
BHMA  Builders Hardware Manufacturers Association
www.buildershardware.com  
BIA  Brick Industry Association (The)
www.gobrick.com  
BICSI  BICSI, Inc.
www.bicsi.org  
BIFMA  BIFMA International
(Business and Institutional Furniture Manufacturer's Association)
www.bifma.com
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<th>Acronym</th>
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<td>BISSC</td>
<td>Baking Industry Sanitation Standards Committee</td>
<td>(866) 342-4772</td>
<td><a href="http://www.bissc.org">www.bissc.org</a></td>
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<td>BOCA</td>
<td>BOCA (Building Officials and Code Administrators International Inc.) (See ICC)</td>
<td>(800) 232-3282</td>
<td><a href="http://www.copper.org">www.copper.org</a></td>
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<td>BWF</td>
<td>Badminton World Federation (Formerly: International Badminton Federation)</td>
<td>(866) 858-1555</td>
<td><a href="http://www.bwfbadminton.org">www.bwfbadminton.org</a></td>
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<td>CDA</td>
<td>Copper Development Association</td>
<td>(603) 9283 7155</td>
<td><a href="http://www.cellulose.org">www.cellulose.org</a></td>
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<tr>
<td>CEA</td>
<td>Canadian Electricity Association</td>
<td>(866) 881-2462</td>
<td><a href="http://www.cellulose.org">www.cellulose.org</a></td>
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<td>CEA</td>
<td>Consumer Electronics Association</td>
<td>(301) 596-2583</td>
<td><a href="http://www.chainlinkinfo.org">www.chainlinkinfo.org</a></td>
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<tr>
<td>CFSEI</td>
<td>Cold-Formed Steel Engineers Institute</td>
<td>(202) 263-4488</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CGA</td>
<td>Compressed Gas Association</td>
<td>(866) 465-4732</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CIMA</td>
<td>Cellulose Insulation Manufacturers Association</td>
<td>(212) 251-7200</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CISCA</td>
<td>Ceilings &amp; Interior Systems Construction Association</td>
<td>(301) 596-2583</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
<td>(404) 622-0073</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CLFMI</td>
<td>Chain Link Fence Manufacturers Institute</td>
<td>(703) 724-1128</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CPA</td>
<td>Composite Panel Association</td>
<td>(866) 465-2523</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CRI</td>
<td>Carpet and Rug Institute (The)</td>
<td>(847) 517-1200</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CRRC</td>
<td>Cool Roof Rating Council</td>
<td>(800) 328-6306</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
<td>(800) 463-6727</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CSA</td>
<td>Canadian Standards Association</td>
<td>(866) 342-4772</td>
<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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CSA     CSA International
       (Formerly: IAS - International Approval Services)
       www.csa-international.org
CSI     Construction Specifications Institute (The)
       www.csinet.org
CSSB    Cedar Shake & Shingle Bureau
       www.cedarbureau.org
CTI     Cooling Technology Institute
       (Formerly: Cooling Tower Institute)
       www.cti.org
CWC     Composite Wood Council
       (See CPA)
DASMA   Door and Access Systems Manufacturers Association
       www.dasma.com
DHI     Door and Hardware Institute
       www.dhi.org
ECA     Electronic Components Association
       www.ec-central.org
ECAMA   Electronic Components Assemblies & Materials Association
       (See ECA)
EIA     Electronic Industries Alliance
       (See TIA)
EIMA    EIFS Industry Members Association
       www.eima.com
EJMA    Expansion Joint Manufacturers Association, Inc.
       www.ejma.org
ESD     ESD Association
       (Electrostatic Discharge Association)
       www.esda.org
ESTA    Entertainment Services and Technology Association
       (See PLASA)
EVO     Efficiency Valuation Organization
       www.evo-world.org
FIBA    Fédération Internationale de Basketball
       (The International Basketball Federation)
       www.fiba.com
FIVB    Fédération Internationale de Volleyball
       (The International Volleyball Federation)
       www.fivb.org
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<td>FM Approvals</td>
<td>FM Approvals LLC</td>
<td>(781) 762-4300</td>
<td><a href="http://www.fmglobal.com">www.fmglobal.com</a></td>
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<td>FM Global</td>
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<td>(401) 275-3000</td>
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<td>FRSA</td>
<td>Florida Roofing, Sheet Metal &amp; Air Conditioning Contractors Association, Inc.</td>
<td>(407) 671-3772</td>
<td><a href="http://www.floridaroof.com">www.floridaroof.com</a></td>
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<td>FSA</td>
<td>Fluid Sealing Association</td>
<td>(610) 971-4850</td>
<td><a href="http://www.fluidsealing.com">www.fluidsealing.com</a></td>
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<td>FSC</td>
<td>Forest Stewardship Council U.S.</td>
<td>(612) 353-4511</td>
<td><a href="http://www.fscus.org">www.fscus.org</a></td>
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<td>GA</td>
<td>Gypsum Association</td>
<td>(301) 277-8686</td>
<td><a href="http://www.gypsum.org">www.gypsum.org</a></td>
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<td>GANA</td>
<td>Glass Association of North America</td>
<td>(785) 271-0208</td>
<td><a href="http://www.glasswebsite.com">www.glasswebsite.com</a></td>
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<td>GS</td>
<td>Green Seal</td>
<td>(202) 872-6400</td>
<td><a href="http://www.greenseal.org">www.greenseal.org</a></td>
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<td>HI</td>
<td>Hydraulic Institute</td>
<td>(973) 267-9700</td>
<td><a href="http://www.pumps.org">www.pumps.org</a></td>
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<td>HI/GAMA</td>
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<td>HPVA</td>
<td>Hardwood Plywood &amp; Veneer Association</td>
<td>(703) 435-2900</td>
<td><a href="http://www.hpva.org">www.hpva.org</a></td>
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<td>HPW</td>
<td>H. P. White Laboratory, Inc.</td>
<td>(410) 838-6550</td>
<td><a href="http://www.hpwhite.com">www.hpwhite.com</a></td>
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<td>IAPSC</td>
<td>International Association of Professional Security Consultants</td>
<td>(415) 536-0288</td>
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<td>(888) 422-7233</td>
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<td>ICEA</td>
<td>Insulated Cable Engineers Association, Inc.</td>
<td>(770) 830-0369</td>
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<td>IGSHPA</td>
<td>International Ground Source Heat Pump Association</td>
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<td>ITU</td>
<td>International Telecommunication Union</td>
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<td>KCMA</td>
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<td>(703) 264-1690</td>
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<td>LPI</td>
<td>Lightning Protection Institute</td>
<td>(800) 488-6864</td>
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<td>MBMA</td>
<td>Metal Building Manufacturers Association</td>
<td>(216) 241-7333</td>
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<td>MCA</td>
<td>Metal Construction Association</td>
<td>(847) 375-4718</td>
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<td>MFMA</td>
<td>Maple Flooring Manufacturers Association, Inc.</td>
<td>(888) 480-9138</td>
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<td>MFMA</td>
<td>Metal Framing Manufacturers Association, Inc.</td>
<td>(312) 644-6610</td>
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<td>MHIA</td>
<td>Material Handling Industry of America</td>
<td>(800) 345-1815 (704) 676-1190</td>
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<td>MIA</td>
<td>Marble Institute of America</td>
<td>(440) 250-9222</td>
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<td>MMPA</td>
<td>Moulding &amp; Millwork Producers Association (Formerly: Wood Moulding &amp; Millwork Producers Association)</td>
<td>(800) 550-7889 (530) 661-9591</td>
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<td>MPI</td>
<td>Master Painters Institute</td>
<td>(888) 674-8937 (604) 298-7578</td>
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<td>MSS</td>
<td>Manufacturers Standardization Society of The Valve and Fittings Industry Inc.</td>
<td>(703) 281-6613</td>
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<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
<td>(630) 942-6591</td>
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<td>NACE</td>
<td>NACE International (National Association of Corrosion Engineers International)</td>
<td>(800) 797-6223 (281) 228-6200</td>
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<td>NADCA</td>
<td>National Air Duct Cleaners Association</td>
<td>(202) 737-2926</td>
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<td>NAIMA</td>
<td>North American Insulation Manufacturers Association</td>
<td>(703) 684-0084</td>
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<td>NBGQA</td>
<td>National Building Granite Quarries Association, Inc.</td>
<td>(800) 557-2848</td>
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<td>NCAA</td>
<td>National Collegiate Athletic Association (The)</td>
<td>(317) 917-6222</td>
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<td>NCMA</td>
<td>National Concrete Masonry Association</td>
<td>(703) 713-1900</td>
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<td>NEBB</td>
<td>National Environmental Balancing Bureau</td>
<td>(301) 977-3698</td>
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<td>NECA</td>
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<td>(301) 657-3110</td>
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<td>NeLMA</td>
<td>Northeastern Lumber Manufacturers Association</td>
<td>(207) 829-6901</td>
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<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
<td>(703) 841-3200</td>
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<td>NETA</td>
<td>InterNational Electrical Testing Association</td>
<td>(888) 300-6382</td>
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<td>(National Fire Protection Association)</td>
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<td>(301) 589-1776</td>
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<td>(800) 933-0318</td>
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<td>(604) 524-2393</td>
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<td>NSF</td>
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<td>(800) 673-6275</td>
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<td>(National Sanitation Foundation International)</td>
<td>(734) 769-8010</td>
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<td>NSPE</td>
<td>National Society of Professional Engineers</td>
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<td>NSSGA</td>
<td>National Stone, Sand &amp; Gravel Association</td>
<td>(800) 342-1415</td>
<td><a href="http://www.nssga.org">www.nssga.org</a></td>
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<td>(703) 525-8788</td>
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<td>NTMA</td>
<td>National Terrazzo &amp; Mosaic Association, Inc. (The)</td>
<td>(800) 323-9736</td>
<td><a href="http://www.ntma.com">www.ntma.com</a></td>
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<td>NWFA</td>
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<td>(800) 422-4556</td>
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<td>(636) 519-9663</td>
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<td>PCI</td>
<td>Precast/Prestressed Concrete Institute</td>
<td>(312) 786-0300</td>
<td><a href="http://www.pci.org">www.pci.org</a></td>
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<td>PDI</td>
<td>Plumbing &amp; Drainage Institute</td>
<td>(800) 589-8956</td>
<td><a href="http://www.pdionline.org">www.pdionline.org</a></td>
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<td>RCSC</td>
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<td><a href="http://www.boltcouncil.org">www.boltcouncil.org</a></td>
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<td>RFCI</td>
<td>Resilient Floor Covering Institute</td>
<td>(706) 882-3833</td>
<td><a href="http://www.rfci.com">www.rfci.com</a></td>
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<td>RIS</td>
<td>Redwood Inspection Service</td>
<td>(925) 935-1499</td>
<td><a href="http://www.redwoodinspection.com">www.redwoodinspection.com</a></td>
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<td>SAE</td>
<td>SAE International (Society of Automotive Engineers)</td>
<td>(877) 606-7323</td>
<td><a href="http://www.sae.org">www.sae.org</a></td>
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<td>SCTE</td>
<td>Society of Cable Telecommunications Engineers</td>
<td>(800) 542-5040</td>
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<td>(847) 458-4647</td>
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<td>SEFA</td>
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<td>(877) 294-5424</td>
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<td>SIA</td>
<td>Security Industry Association</td>
<td>(866) 817-8888</td>
<td><a href="http://www.siaonline.org">www.siaonline.org</a></td>
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<td></td>
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<td>(703) 683-2075</td>
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<td>Reference</td>
<td>Organization Name</td>
<td>Phone Number</td>
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<td>SJI</td>
<td>Steel Joist Institute</td>
<td>(843) 293-1995</td>
<td><a href="http://www.steeljoist.org">www.steeljoist.org</a></td>
</tr>
<tr>
<td>SMA</td>
<td>Screen Manufacturers Association</td>
<td>(773) 636-0672</td>
<td><a href="http://www.smainfo.org">www.smainfo.org</a></td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors' National Association</td>
<td>(703) 803-2980</td>
<td><a href="http://www.smacna.org">www.smacna.org</a></td>
</tr>
<tr>
<td>SMPTE</td>
<td>Society of Motion Picture and Television Engineers</td>
<td>(914) 761-1100</td>
<td><a href="http://www.smpte.org">www.smpte.org</a></td>
</tr>
<tr>
<td>SPFA</td>
<td>Spray Polyurethane Foam Alliance</td>
<td>(800) 523-6154</td>
<td><a href="http://www.sprayfoam.org">www.sprayfoam.org</a></td>
</tr>
<tr>
<td>SPIB</td>
<td>Southern Pine Inspection Bureau</td>
<td>(850) 434-2611</td>
<td><a href="http://www.spib.org">www.spib.org</a></td>
</tr>
<tr>
<td>SPRI</td>
<td>Single Ply Roofing Industry</td>
<td>(781) 647-7026</td>
<td><a href="http://www.spri.org">www.spri.org</a></td>
</tr>
<tr>
<td>SSINA</td>
<td>Specialty Steel Industry of North America</td>
<td>(800) 982-0355</td>
<td><a href="http://www.ssina.com">www.ssina.com</a></td>
</tr>
<tr>
<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
<td>(877) 281-7772</td>
<td><a href="http://www.sspc.org">www.sspc.org</a></td>
</tr>
<tr>
<td>STI</td>
<td>Steel Tank Institute</td>
<td>(847) 438-8265</td>
<td><a href="http://www.steeltank.com">www.steeltank.com</a></td>
</tr>
<tr>
<td>SWI</td>
<td>Steel Window Institute</td>
<td>(216) 241-7333</td>
<td><a href="http://www.steelwindows.com">www.steelwindows.com</a></td>
</tr>
<tr>
<td>SWPA</td>
<td>Submersible Wastewater Pump Association</td>
<td>(847) 681-1868</td>
<td><a href="http://www.swpa.org">www.swpa.org</a></td>
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<tr>
<td>TCA</td>
<td>Tilt-Up Concrete Association</td>
<td>(319) 895-6911</td>
<td><a href="http://www.tilt-up.org">www.tilt-up.org</a></td>
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<tr>
<td>TCNA</td>
<td>Tile Council of North America, Inc.</td>
<td>(864) 646-8453</td>
<td><a href="http://www.tileusa.com">www.tileusa.com</a></td>
</tr>
<tr>
<td>TEMA</td>
<td>Tubular Exchanger Manufacturers Association, Inc.</td>
<td>(914) 332-0040</td>
<td><a href="http://www.tema.org">www.tema.org</a></td>
</tr>
<tr>
<td>TIA</td>
<td>Telecommunications Industry Association</td>
<td>(703) 907-7700</td>
<td><a href="http://www.tiaonline.org">www.tiaonline.org</a></td>
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<tr>
<td>TIA/EIA</td>
<td>Telecommunications Industry Association/Electronic Industries Alliance</td>
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## REFERENCES

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<tr>
<td>TMS</td>
<td>The Masonry Society</td>
<td>(303) 939-9700</td>
<td><a href="http://www.masonrysociety.org">www.masonrysociety.org</a></td>
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<tr>
<td>TPI</td>
<td>Truss Plate Institute</td>
<td>(703) 683-1010</td>
<td><a href="http://www.tpinst.org">www.tpinst.org</a></td>
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<td>TPI</td>
<td>Turfgrass Producers International</td>
<td>(800) 405-8873 (847) 649-5555</td>
<td><a href="http://wwwLe.turfgrasssod.org">wwwLe.turfgrasssod.org</a></td>
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<td>TRI</td>
<td>Tile Roofing Institute</td>
<td>(312) 670-4177</td>
<td><a href="http://www.tileroofing.org">www.tileroofing.org</a></td>
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<tr>
<td>UBC</td>
<td>Uniform Building Code</td>
<td></td>
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<td>(See ICC)</td>
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<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc.</td>
<td>(877) 854-3577</td>
<td><a href="http://www.ul.com">www.ul.com</a></td>
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<tr>
<td>UNI</td>
<td>Uni-Bell PVC Pipe Association</td>
<td>(972) 243-3902</td>
<td><a href="http://www.uni-bell.org">www.uni-bell.org</a></td>
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<tr>
<td>USAV</td>
<td>USA Volleyball</td>
<td>(888) 786-5539 (719) 228-6800</td>
<td><a href="http://www.usavolleyball.org">www.usavolleyball.org</a></td>
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<tr>
<td>USGBC</td>
<td>U.S. Green Building Council</td>
<td>(800) 795-1747</td>
<td><a href="http://www.usgbc.org">www.usgbc.org</a></td>
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<tr>
<td>USITT</td>
<td>United States Institute for Theatre Technology, Inc.</td>
<td>(800) 938-7488 (315) 463-6463</td>
<td><a href="http://www.usitt.org">www.usitt.org</a></td>
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<tr>
<td>WASTEC</td>
<td>Waste Equipment Technology Association</td>
<td>(800) 424-2869 (202) 244-4700</td>
<td><a href="http://www.wastec.org">www.wastec.org</a></td>
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<tr>
<td>WCLIB</td>
<td>West Coast Lumber Inspection Bureau</td>
<td>(800) 283-1486 (503) 639-0651</td>
<td><a href="http://www.wclib.org">www.wclib.org</a></td>
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<tr>
<td>WCMA</td>
<td>Window Covering Manufacturers Association</td>
<td>(212) 297-2122</td>
<td><a href="http://www.wcmant.net.org">www.wcmant.net.org</a></td>
<td></td>
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<tr>
<td>WDMA</td>
<td>Window &amp; Door Manufacturers Association</td>
<td>(800) 223-2301 (312) 321-6802</td>
<td><a href="http://www.wdma.com">www.wdma.com</a></td>
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</tr>
<tr>
<td>WI</td>
<td>Woodwork Institute</td>
<td>(916) 372-9943</td>
<td>(Formerly: WIC - Woodwork Institute of California) <a href="http://www.wicnet.org">www.wicnet.org</a></td>
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<tr>
<td>WMMPA</td>
<td>Wood Moulding &amp; Millwork Producers Association</td>
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<td>(See MMPA)</td>
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<tr>
<td>WSRCA</td>
<td>Western States Roofing Contractors Association</td>
<td>(800) 725-0333 (650) 938-5441</td>
<td><a href="http://www.wsrca.com">www.wsrca.com</a></td>
<td></td>
</tr>
<tr>
<td>WWPA</td>
<td>Western Wood Products Association</td>
<td>(503) 224-3930</td>
<td><a href="http://www.wwpa.org">www.wwpa.org</a></td>
<td></td>
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</table>
B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

<table>
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<tr>
<th>Agency</th>
<th>Name</th>
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<tr>
<td>DIN</td>
<td>Deutsches Institut für Normung e.V.</td>
<td>(49) 30 2601-0</td>
<td><a href="http://www.din.de">www.din.de</a></td>
</tr>
<tr>
<td>IAPMO</td>
<td>International Association of Plumbing and Mechanical Officials</td>
<td>(909) 472-4100</td>
<td><a href="http://www.iapmo.org">www.iapmo.org</a></td>
</tr>
<tr>
<td>ICC</td>
<td>International Code Council</td>
<td>(888) 422-7233</td>
<td><a href="http://www.iccsafe.org">www.iccsafe.org</a></td>
</tr>
<tr>
<td>ICC-ES</td>
<td>ICC Evaluation Service, LLC</td>
<td>(800) 423-6587</td>
<td>(562) 699-0543</td>
</tr>
<tr>
<td>COE</td>
<td>Army Corps of Engineers</td>
<td>(202) 761-0011</td>
<td><a href="http://www.usace.army.mil">www.usace.army.mil</a></td>
</tr>
<tr>
<td>CPSC</td>
<td>Consumer Product Safety Commission</td>
<td>(800) 638-2772</td>
<td>(301) 504-7923</td>
</tr>
<tr>
<td>DOC</td>
<td>Department of Commerce</td>
<td>(301) 975-4040</td>
<td><a href="http://www.nist.gov">www.nist.gov</a></td>
</tr>
<tr>
<td>DOD</td>
<td>Department of Defense</td>
<td>(215) 697-2664</td>
<td><a href="http://dodssp.daps.dla.mil">http://dodssp.daps.dla.mil</a></td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
<td>(202) 586-9220</td>
<td><a href="http://www.energy.gov">www.energy.gov</a></td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
<td>(202) 272-0167</td>
<td><a href="http://www.epa.gov">www.epa.gov</a></td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
<td>(866) 835-5322</td>
<td><a href="http://www.faa.gov">www.faa.gov</a></td>
</tr>
<tr>
<td>GSA</td>
<td>General Services Administration</td>
<td>(800) 488-3111</td>
<td>(202) 619-8925</td>
</tr>
<tr>
<td>HUD</td>
<td>Department of Housing and Urban Development</td>
<td>(202) 708-1112</td>
<td><a href="http://www.hud.gov">www.hud.gov</a></td>
</tr>
<tr>
<td>LBL</td>
<td>Lawrence Berkeley National Laboratory</td>
<td>(510) 486-4000</td>
<td>Environmental Energy Technologies Division <a href="http://eetd.lbl.gov">http://eetd.lbl.gov</a></td>
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REFERENCES
Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

OSHA  Occupational Safety & Health Administration  www.osha.gov  (800) 321-6742
SD    Department of State  www.state.gov  (202) 647-4000
TRB   Transportation Research Board  National Cooperative Highway Research Program  www.trb.org  (202) 334-2934
USDA  Department of Agriculture  Agriculture Research Service  U.S. Salinity Laboratory  www.ars.usda.gov  (202) 720-3656
USDA  Department of Agriculture  Rural Utilities Service  www.usda.gov  (202) 720-2791
USDJ  Department of Justice  Office of Justice Programs  National Institute of Justice  www.ojp.usdoj.gov  (202) 307-0703
USP   U.S. Pharmacopeia  www.usp.org  (800) 227-8772  (301) 881-0666

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

      Available from Government Printing Office  www.gpo.gov/fdsys
DOD   Department of Defense  (215) 697-2664
      Military Specifications and Standards  http://dodssp.daps.dla.mil
DSCC  Defense Supply Center Columbus  (See FS)
FED-STD Federal Standard  (See FS)
FS    Federal Specification  (215) 697-2664
      Available from Department of Defense Single Stock Point  http://dodssp.daps.dla.mil
      Available from Defense Standardization Program
www.dsp.dla.mil

Available from General Services Administration (800) 488-3111
www.gsa.gov (202) 619-8925

Available from National Institute of Building Sciences/Whole Building Design Guide (202) 289-7800
www.wbdg.org/ccb

MILSPEC Military Specification and Standards (See DOD)

USAB United States Access Board (800) 872-2253
www.access-board.gov (202) 272-0080

USATBCB U.S. Architectural & Transportation Barriers Compliance Board (See USAB)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00
SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1. Nothing in this Section is intended to limit types and amounts of temporary work required, and no omission from this Section will be recognized as an indication by Architect/Engineer that such temporary activity is not required for successful completion of the Work. The use of alternative facilities equivalent to those specified is the Contractor's option, subject to Architect/Engineer's and University acceptance.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 01 35 46 “Indoor Air Quality” for temporary facility work including HVAC, air filtration, moisture management, air filtration and dust control partitions required to comply with indoor air quality requirements during construction.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, University's construction forces, Architect/Engineer, testing agencies, and authorities having jurisdiction.

B. Use Charges: As follows:

1. For new construction: Arrange for and pay for water, sewer, electric power, steam and chilled water use charges for utility usage by all entities for construction operations.
2. For renovations of existing facilities: Arrange for and University will pay for all use charges.

C. Temporary Metering: For all utility connection; sub-meter at point of connection to existing systems.

1. Temporary utility meter must be approved by University Campus Energy Engineer.
2. Meters shall be operational prior to any use of utility for temporary heating.
1.4  INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

B. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
5. Other dust-control measures.

1.5  QUALITY ASSURANCE

A. General: Comply with governing regulations and utility company regulations and recommendations for the construction of temporary facilities including, but not necessarily limited to, code compliances, permits, inspections, testing, health, safety, pollution and environmental compliances.


D. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

E. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

F. Accessible Temporary Egress: Where temporary accessible egress from existing buildings or portions thereof is provided, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6  PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before University's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide both new or used materials and equipment for temporary facilities, which are in substantially undamaged and serviceable condition. Provide types and qualities which are recognized in the construction industry as suitable for the intended use in each application. Comply with Utility Company requirements as applicable.

2.2 TEMPORARY FACILITIES N/A

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Digital Camera: Minimum 12 megapixel; available in field office for use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate, expand and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Use qualified workers for the installation of temporary facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, University, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Comply with requirements in Section 01 10 00 “Summary” for existing utility disruption procedures.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Where available, connect to University's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to University. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Obtain and pay for all required water taps.
D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of University's existing toilet facilities is not permitted.
2. Provide temporary toilets within available site area in location approved by University which will best serve the needs of construction personnel.
3. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each sanitary facility, and provide appropriate waste paper containers for used materials.
4. At Contractor’s option, provide drinking water for construction personnel by either water-system-connected drinking fountains or by containerized tap dispensers with paper cups (or both).

E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. HVAC Equipment: Unless University authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   a. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   b. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   c. Permanent HVAC System: If University authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air and exhaust grille in system and remove at end of construction. Clean and adjust HVAC system and put in new condition before Completion as required in Section 01 77 00 "Closeout Procedures".

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
   a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
   b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide weatherproof, grounded, electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Include, as required, transformers, overload protected disconnects, automatic ground fault interrupters and main distribution switchgear. Maintain equipment in a condition acceptable to University.

1. Install electric power service overhead unless otherwise indicated.
2. Where available capacity exists in existing system, connect temporary service to University's existing power source, as directed by University.
3. Provide separate connection for power and for lighting.
4. Provide sufficient 220v outlets for special tools, welding equipment and similar devices requiring such service at locations where required.
5. Provide sufficient circuits and duplex 120v single phase outlets so located that any part of the work can be reached with a 75 foot extension cord to accommodate normal power tools and supplemental lighting.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Provide temporary light to levels and as required by governing regulations but not less than minimum 5 foot-candle illumination in all areas accessible to workers during hours they are at the job; minimum 10 foot-candles for shop areas; 20 foot-candles or more where detailed or finishing work is being done, supplemented as may be required.
2. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
3. Install lighting for Project identification sign.
4. Where permanent light fixtures have been used for temporary lighting, supply temporary lamps and replace with new lamps at time of Completion.
5. Provide lighting in stairways and exits at all times.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect/Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to University.

B. Temporary Walks: Construct and maintain temporary walks around the construction work and to offices, toilets and similar locations on the site.

C. Parking: Comply with requirements in Section 01 10 00 “Summary.”

D. Project Signs: Provide Project signs at locations indicated or directed. Unauthorized signs are not permitted.

1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
a. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

1. Coordinate with University Project Manager to obtain approval from University Environmental Services Manager.
2. Provide waste chutes as required in accordance with applicable laws and regulations.

F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. The selection of type, size and number of hoisting facilities is the solely the responsibility of the Contractor.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

G. Temporary Elevator Use: Use of elevators is not permitted without prior written approval of the Architect/Engineer and University Project Manager.

H. Existing Elevator Use: Not Permitted.

I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

J. Existing Stair Usage: Use of University's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to University. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Protection of Work: Protect in-progress and completed work from damage or deterioration, other than normal weathering of exposed materials, through construction duration until completion, as appropriate and as recommended by manufacturer and Installer.

1. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects, and storage.
2. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.
3. Always protect excavation, trenches, and building, from damage from rain water, spring water, ground water, backing up of drains or sewers. Provide pumps, equipment, enclosures, to provide this protection.
4. Remove protective coverings and materials at the appropriate time but no later than final cleaning operations.
C. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

D. Tree and Plant Protection: Install temporary fencing or guard located outside the drip line of trees to protect vegetation from damage arising out of construction operations, including cutting, breaking or skinning of roots and skinning or bruising of bark. Protect tree root systems from damage, flooding, and erosion.

1. Do not stockpile construction materials or excavated materials inside dripline.
2. University will identify historically recorded trees and vegetation not to be disturbed.
3. Water trees and other vegetation to remain as required to maintain their health for the duration of the Project.
4. Repair or replace trees and vegetation damaged by construction operations in a manner acceptable to Architect/Engineer. Use a qualified tree surgeon to perform the work.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

F. Security: Provide security program and facilities to protect the Work, existing facilities, and University operations and to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Coordinate with University Police.
2. Provide lockable entrances and lock entrances at end of each work day.
3. After review and approval by University, install temporary enclosure around partially completed areas of construction.
4. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting wherever required to prevent accidents and losses.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Covered Walkway: Where regulations require or where a public roadway/walkway adjoins the Project site and materials may be hoisted across the walkway, erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead waterproof decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work in a manner acceptable to the Architect/Engineer and University.
4. Extend back wall beyond structure to complete the enclosure fence.
J. Temporary Partitions: Provide floor-to-floor or floor-to-ceiling dustproof partitions terminating in dustproof floor or ceiling above to limit dust and dirt migration and to separate existing active elevator hoistways and other areas occupied by University from dust, fumes and noise in compliance with Section 01 35 46 “Indoor Air Quality” and the following:

1. Construct dustproof partitions with 5/8 inch gypsum wallboard with joints taped on occupied side, and 1/2 inch fire-retardant-treated plywood on construction operations side.
2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.
7. At elevator hoistway entrances not used during construction, seal openings with plastic sheet and duct tape.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Fire Extinguishers: Minimum one per floor at or near useable exit.
   a. Provide additional extinguishers where convenient and effective for intended purpose.
   b. Comply with NFPA 10 to the extent applicable.
2. Strictly enforce site prohibition against smoking.
3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
4. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Coordinate with University Project Manager to review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
5. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
6. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes for fighting fires.
7. Store combustible materials in containers in fire-safe locations.
8. Permanent Fire Protection System: Complete and make operational at earliest possible date. Instruct site personnel on use of permanent system.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Comply with requirements in Section 01 35 46 “Indoor Air Quality Procedures.”

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
1. Do not permit temporary offices and similar temporary or permanent spaces to be used as living quarters or for other unintended occupancies or uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Janitorial Services: Provide daily janitorial services for temporary offices, toilets, and similar areas at the project site. Require users of other temporary facilities to maintain clean and orderly premises.

D. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

E. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

F. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion, unless Architect/Engineer requests that it be retained for a longer period of time. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. University reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00
SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 01 21 00 "Allowances" for products selected under an allowance, if applicable.
   2. Section 01 23 00 "Alternates" for products selected under an alternate, if applicable.
   3. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
   4. Section 01 42 00 "References" for applicable industry standards for products specified.
   5. Section 01 77 00 “Closeout Procedures” for submittal of project warranties.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Requests for consideration of comparable products will only be entertained during bidding.
2. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
3. Architect/Engineer's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation of a comparable product request. Architect/Engineer will notify Contractor of approval or rejection of proposed comparable product.
   a. Form of Approval: Written Addendum.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

B. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.

1. Name of product and manufacturer.
2. Model and serial number.
3. Capacity.
4. Speed.
5. Ratings.
6. Power characteristics (if applicable).
7. UL label or compliance (if applicable).

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents. Such disclaimers and limitations do not relieve warranty requirements on Work that incorporates product nor do they relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to University.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for University.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time and Form: Comply with requirements in Section 01 77 00 "Closeout Procedures."

D. Warranty Requirements:
1. **Related Damages and Losses:** When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

2. **Reinstatement of Warranty:** When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

3. **Replacement Cost:** Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the University has benefited from use of the Work through a portion of its anticipated useful service life.

4. **University's Recourse:**
   a. Written warranties made to the University are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the University can enforce such other duties, obligations, rights, or remedies.
   b. **Rejection of Warranties:** The University reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
   c. The University reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

**PART 2 - PRODUCTS**

2.1 **PRODUCT SELECTION PROCEDURES**

A. **General Product Requirements:** Provide products that comply with the Contract Documents, are undamaged, are asbestos free, and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. University reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect/Engineer will make selection.
6. **Or Equal:** For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product and provide only products previously approved during bid phase by written Addendum. The determination of equivalence is at the sole discretion of the Architect/Engineer who has no obligation to prove non-equivalence.
7. Mechanical and electrical equipment design and their space requirements are based on the first named item of the Section in which specified or that scheduled on the Drawings. If other than the first named or scheduled item listed for use is selected, modification to other elements of Work may be required. Show all such modification on shop drawings and submittals as appropriate. The cost of such modifications is solely the responsibility of the Contractor.
8. Where manufacturers are listed as acceptable for specific proprietary products but precise identification by model, series, or trade name is not specified, submit detailed product information for such products for Architect/Engineer's acceptance prior to ordering. Include specific requirements for modifications to other construction, including but not limited to, power and utility requirements, characteristics, capacities, size and locations. The cost of such modifications is solely the responsibility of the Contractor.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. If proposing a comparable product by another manufacturer, whether named or not, provide a custom product if manufacturer's standard product does not include salient features of the Basis-of-Design product indicated. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

6. Contractor's Option: Where materials, products, systems or methods are specified to be selected from a list of options, subject to compliance with requirements, the choice of which material, method, product or system will be solely at the Contractor's discretions. There will be no change in Contract Sum or Time because of such choice.

C. Visual Matching Specification: Where Specifications require "match Architect/Engineer's sample", provide a product that complies with requirements and matches Architect/Engineer's sample. Architect/Engineer's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect/Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect/Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Prior to bid, Architect/Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will reject request:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
      2. Field engineering and surveying.
      3. Installation of the Work.
      4. Cutting and patching.
      5. Coordination of University-installed products.
      6. Progress cleaning.
      7. Starting and adjusting.
      8. Protection of installed construction.
   
   B. Related Requirements:
      1. Section 01 10 00 "Summary" for limits on use of Project site and procedures related to utility interruptions.

1.3 DEFINITIONS
   A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
   B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For land surveyor or professional engineer.
   B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
   C. Cutting and Patching Plan and Request: Submit plan and request describing procedures at least 21 calendar days prior to the time cutting and patching will be performed.
      1. Submit request whenever cutting and patching operation affect:
a. Work of the University or any separate contractor.
b. Structural value or integrity of any element of the Project.
c. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
d. Efficiency, operational life, maintenance or safety of operational elements.
e. Visual qualities of sight-exposed elements.
f. Cutting new openings in existing structural concrete walls, floors and suspended slabs.
g. Cutting new openings in existing roofs and roofing materials.
h. Cutting exterior walls.
i. Cutting into shafts.

2. Include the following information:

a. Extent: Describe reason for and extent of each occurrence of cutting and patching, including explanation of why cutting and patching operation cannot be reasonable avoided.
b. Changes to In-Place Construction: Describe cutting and patching methods and anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
c. Products: List products to be used for patching and firms or entities that will perform patching work.
d. Trades: Indicate trades and subcontractors who will perform the work.
e. Dates: Indicate when cutting and patching will be performed.
f. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

1) Include description of provisions for temporary services and systems during interruption of permanent services and systems.
2) Comply with requirements of Section 01 10 00 “Summary” related to existing utility and system interruptions.

g. Structural Elements: Where cutting and patching structural elements requires the addition of reinforcement, submit details and calculations signed and sealed by an Engineer registered in the State of Colorado. Indicate how new reinforcing will be integrated with original structure.

3. Limitations: Approval of cutting and patching request does not waive right of Architect/Engineer or University to later require complete removal and replacement of work found to be unsatisfactorily cut and patched.

D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

E. Final Property Survey: Submit one electronic and two paper copies showing the Work performed and record survey data.

1. Include certified statement that lines and levels of the work comply with the requirements of the Contract Documents and listing authorized or accepted deviations, cross-referenced to Change Order number, where applicable.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect/Engineer of locations and details of cutting and await directions from Architect/Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include but are not limited to the following:
   a. Primary operational systems and equipment.
   b. Fire separation assemblies.
   c. Air or smoke barriers.
   d. Fire-suppression systems.
   e. Mechanical systems piping and ducts.
   f. Control systems.
   g. Communication systems.
   h. Fire-detection and -alarm systems.
   i. Conveying systems.
   j. Electrical wiring systems.
   k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction exposed to the exterior or exposed in occupied spaces in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect/Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

5. Hazardous Materials: Do not proceed with cutting and patching operations until University has examined existing construction for the presence of asbestos and/or lead-based coatings. Comply with requirements in Section 01 35 00 “Special Procedures.”

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 Section “Sustainable Design Requirements.”

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect/Engineer for the visual and functional performance of in-place materials.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work. Notify University Project Manager and Architect/Engineer and obtain approval prior to disturbing, moving or penetrating soil.

1. Arrange for locating buried utilities including water and sewer lines within construction limits. Obtain location information and stake all known utilities prior to commencing construction activities.

   a. Contact Utility Notification Center of Colorado (UNCC), 1-800-922-1987, and comply with UNCC guidelines.

2. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

3. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility or University, as appropriate, that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect/Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect/Engineer promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect/Engineer when deviations from required lines and levels exceed allowable tolerances. Record deviation which are accepted (i.e., not corrected) on record drawings in accordance with the requirements of Section 01 78 39 “Project Record Documents.”
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect/Engineer.

3.4 FIELD ENGINEERING

A. Identification: University will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect/Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect/Engineer before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."
3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated to the extent they are more explicit or stringent than requirements of the Contract Documents.

C. Install products at the time and under conditions, including weather that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Isolate each part of complete installation from incompatible material as needed to prevent deterioration.

E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

G. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

H. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

I. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned, true and level as applicable, with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

J. Attachment to Concrete:
   1. No drilled inserts or powder-actuated fasteners are permitted in pre-stressed concrete except as specifically authorized by Contractor and carried out under the direct supervision of its Superintendent.
   2. Only those devices with a maximum controlled penetration of 3/4 inch or less will be permitted. Make holes through slabs by means of sleeves placed no closer than 2 inch from tensioning cables. Core drilling will not be permitted unless unavoidable and as specified for cutting and patching in this Section.
K. Joints: Unless indicated otherwise, make joints of uniform width. Where joint locations in exposed work are required but not indicated, arrange joints for the best visual effect. Confirm arrangement with Architect/Engineer before proceeding. Fit exposed connections together to form hairline joints.

L. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Responsibility: Provide cutting and patching work, including attendant excavation and backfill required to complete the Work or to:

1. Make components fit together properly.
2. Uncover portions of the Work to provide for installation of ill-timed work.
3. Remove and replace defective work or work not conforming to requirements of Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

C. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

D. Temporary Support: Provide temporary support of work to be cut.

E. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

F. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

G. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

H. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations. Employ methods which will prevent settlement or damage to other work.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements, including tolerance, specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

J. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 UNIVERSITY-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for University's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by University's construction personnel.

1. Construction Schedule: Inform University of Contractor's preferred construction schedule for University's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify University if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include University's construction personnel at preinstallation conferences covering portions of the Work that are to receive University's work. Attend preinstallation conferences conducted by University's construction personnel if portions of the Work depend on University's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

2. Do not hold waste materials more than seven calendar days during normal weather or three calendar days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.

B. Collection Point: Review location with University and obtain approval.

C. Site: Maintain Project site free of waste materials and debris.

D. Wind Blown Debris: Prevent spread of trash, debris, cartons, packing material, or other waste on or off Project site by wind.

E. Dust: Sprinkle dusty debris with water.

F. Packing Materials: Immediately after uncrating or unpacking materials or equipment, remove all crating, lumber, excelsior, wrapping or other like combustible materials from building to central collection facility.

G. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

H. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

I. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

J. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

K. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

Snow and ice: Remove snow and ice from sidewalks adjacent to site and from access ways to building and construction site.

At frequency required by University and/or governing authority, clean adjacent and nearby streets of dirt resulting from construction operations.

STARTING AND ADJUSTING

Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

PROTECTION OF INSTALLED CONSTRUCTION

Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

Comply with manufacturer's written instructions for temperature and relative humidity.

Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
19. Electrical current.
20. High speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Misalignment.
25. Excessive weathering.
27. Improper shipping or handling.
28. Theft.
29. Vandalism.

END OF SECTION 01 73 00
SECTION 01 77 00
CLOSEOUT PROCEDURES

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures, including Notice of Completion and Final Inspection procedures.
2. Occupancy procedures, including Notice of Approval of Occupancy/Use and University Supplemental Notice of Occupancy and Use List.
3. Final Acceptance procedures, including Pre-Acceptance Checklist and University Supplemental Building/Project Acceptance List.
4. Inspections after completion.
5. Warranties.
6. Final cleaning.
7. Repair of the Work.

B. Related Requirements:

1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 01 73 00 "Execution" for progress cleaning of Project site.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 79 00 "Demonstration and Training" for requirements for instructing University's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Notice of Completion.

C. Certified List of Incomplete Items: Final submittal at Final Acceptance.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.
C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 NOTICE OF COMPLETION AND SUBSTANTIAL COMPLETION PROCEDURES

A. Procedures and Submittals Prior to Notice of Completion: Complete and submit all of the following items prior to submitting Notice of Completion to Architect/Engineer. Include Contractor’s comprehensive list of items to be completed, corrected or not in compliance with the Drawings and Specifications.

1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's preliminary punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
2. Building Inspection Record: Submit completed record with all required corrections noted.
4. Final Completion Schedule: Submit schedule for performing and completing all work indicated on the Contractor’s list of incomplete items.
5. Submit sustainable design documentation.
6. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
7. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
8. Submit test/adjust/balance records.

B. Final Inspection: Submit Notice of Completion to Architect/Engineer. Upon receipt, Architect/Engineer and University will review and if all items on the University Supplemental Notice of Completion Checklist are complete will, within the timeframe required by the Contract, schedule and make an inspection of the Project to determine whether the Work is substantially complete.

1. Final Punch List: Based on the inspection, Architect/Engineer will prepare a final punch list of work to be completed, work not in compliance with the Drawings or Specifications, and unsatisfactory work for any reason.
2. Re-inspection: If the cumulative number of items identified on the final punch list prevents a determination that the work is substantially complete, complete those items and when complete resubmit Notice of Completion. Upon receipt of resubmittal, Architect/Engineer and University will then schedule and make a re-inspection of the Project to determine whether the Work is substantially complete.

C. Notice of Substantial Completion: When inspection of the Work indicates that the Project is substantially complete and all other Contract provisions required for substantial completion have been satisfied, Architect/Engineer will issue a Notice of Substantial Completion (State Form SBP-07).
1.7  LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A.  Organization of List:  Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.  Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor or as approved by Architect/Engineer.
2.  Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3.  Include the following information at the top of each page:

   a.  Project name.
   b.  Date.
   c.  Name of Architect/Engineer.
   d.  Name of Contractor.
   e.  Page number.

4.  Submit list of incomplete items in the following format:

   a.  MS Excel and PDF electronic file.  Architect/Engineer will return annotated file.

1.8  OCCUPANCY PROCEDURES

A.  Procedures and Submittals Prior to Occupancy:  Complete and submit all items on both State Form SBP-01 “Notice of Approval of Occupancy/Use” and University Supplemental Notice of Occupancy and Use List.

1.9  FINAL ACCEPTANCE PROCEDURES

A.  Procedures and Submittals Prior to Final Acceptance:  Complete and submit all items on both State Form SBP-05 “Pre-Acceptance Checklist” and University Supplemental Building/Project Acceptance List.

B.  Inspection:  Submit a written request for final inspection to determine acceptance a minimum of 10 business days prior to date the work will be completed and ready for final inspection and tests.  On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements.  Architect/Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.  Reinspection:  Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.10  SETTLEMENT AND FINAL PAYMENT

A.  Submit and complete all of the following as a condition precedent to settlement and final payment:

1.  All guarantees and warranties.
2.  All statement to support local sales tax refunds, if any.
3.  Three (3) sets of operation and maintenance manuals.
4.  One (1) set of as-built Contract Documents showing all job changes.
5.  All demonstration and training completed in accordance with Section 01 79 00.
6. All punch list items documented as complete.

B. Final Certificate of Payment: Submit in accordance with the requirements of Section 01 29 00 “Payment Procedures.”

### 1.11 INSPECTIONS AFTER COMPLETION

A. Warranty/Guarantee Inspections: During the warranty period, accompany Architect/Engineer and University Representative, and participate in inspection(s) of the Project to identify defective and deficient work at intervals and as required by the Contract.

B. List of Deficient or Defective Work: Within 10 business days of inspection, Architect/Engineer will provide Contractor with a list of items requiring correction.

C. Remedial Work: Upon receive of itemized list, immediately correct and remedy deficiencies and defects in a manner satisfactory to the Architect/Engineer and University.

### 1.12 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties to the Architect/Engineer prior to advertisement of the Notice of Contractor's Settlement. If the Notice of Acceptance designates a commencement date for warranties other than the date of Notice of Acceptance for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

B. Partial Occupancy: When a designated portion of the Work is completed and occupied or used by the University, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect/Engineer within fifteen (15) calendar days of completion of that designated portion of the Work.

C. Special Warranties: When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the University through the Architect/Engineer for approval prior to final execution. Refer to individual Specification Sections for specific requirements for special warranties.

D. Form of Submittal: Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Number of Copies: Two.
2. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
5. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.
F. List of Extended Warranties: Provide a comprehensive list of all manufacturers’ standard and special warranties with duration greater than one year after Notice of Acceptance. Organize list into an orderly sequence based on table of contents of the Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

2. Do not use sweeping compounds on concrete floors that will leave residue affecting finish floor materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations immediately prior to Occupancy for entire Project or for a designated portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

   d. Remove tools, construction equipment, machinery, and surplus material from Project site.

   e. Remove snow and ice to provide safe access to building.

   f. Clean exposed exterior and interior finishes to a dirt-free condition, free of grease, dust, stains, films, fingerprints, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

   h. Sweep concrete floors broom clean in unoccupied spaces.

   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

   j. Power scrub and power buff resilient flooring surfaces, tile and fluid-applied flooring.

   k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
CLOSEOUT PROCEDURES

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

3.3 ATTACHMENTS

A. Samples of the following forms are appended to this Section for reference following End of Section 01 77 00:

1. University of Colorado Denver | Anschutz Medical Campus Supplemental Notice of Occupancy and Use List.
2. University of Colorado Denver | Anschutz Medical Campus Supplemental Building / Project Acceptance List.

END OF SECTION 01 77 00
Supplemental Notice of Occupancy and Use List

Project Name & Number: 
Contractor: 

In addition to completing Notice of Approval of Occupancy / Use (SBP-01), the following items must be completed before Occupancy is approved:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date Completed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Final and formal address posted on the building entries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. A copy of the Contractor’s in-progress red line “as-built” drawings has been given to BMO representative &amp; a 2nd copy is provided for Projects plan room. This is to include landscape drawings showing irrigation installation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Maintenance, operations and spare parts manuals on all installed equipment.</td>
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<td></td>
</tr>
<tr>
<td>4. Notice of Partial Substantial Completion concerning roles/ responsibilities of University and Contractor for security, maintenance, heat, utilities reviewed and accepted.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Manufacturer maintenance, operations and spare parts manuals for fixtures, mechanical, electrical and plumbing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Hardware-maintenance, operations and spare parts manuals for doors &amp; locks, including roll up doors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Warranty Dates and Contact list for all Contractors and Suppliers given to BMO.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Transfer utility account from Contractor to Facilities Operations.</td>
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<td></td>
</tr>
<tr>
<td>9. Site plan to include first floor main isolation locations and plans for each floor to include main utility shutoffs, for utilities to include water, electrical, steam, sewer, fuel supply, telecom, fiber optic and gasses, identified on a set of drawings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. If Commissioning Report is completed, BMO has reviewed/ commented, including electrical, plumbing, mechanical/ HVAC.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. All Contractor provided equipment has new filters &amp; construction filters removed.</td>
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<td></td>
</tr>
<tr>
<td>12. Not Used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Elevator equipment rooms insulated and space conditioned for control system requirements.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. FSS has been provided with copy of Building Department testing and inspection report for window washing equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Roof walking pads to access equipment are installed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. PM to communicate to fire department via Life Safety Officer that building has transitioned to BMO. Alarms at Anschutz Medical Campus report to University Police Dispatch and at Downtown report to designated monitoring company.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### BAS System (Siemens), Energy and Lighting, Fuel Systems, and Power Management
BAS System (Siemens), Energy and Lighting, Fuel Systems, and Power Management must report remotely & verify with University - Engineering.

### Training for BMO and FSS on installed equipment and systems is completed.
Training for BMO and FSS on installed equipment and systems is completed.

### Equipment keys and locks transitioned to Operations, including fire panels, electrical panels, directories and generator panels. Construction cores removed and replaced with permanent cores.
Equipment keys and locks transitioned to Operations, including fire panels, electrical panels, directories and generator panels. Construction cores removed and replaced with permanent cores.

### Access control pathways and junction boxes for installed doors, gates, loading docks and roof access complete. **All wiring and hardware completed and electronic security access controls in place and tested by University Electronic Security.**
Access control pathways and junction boxes for installed doors, gates, loading docks and roof access complete. **All wiring and hardware completed and electronic security access controls in place and tested by University Electronic Security.**

### EH&S is provided, as applicable for project, with fume hood certification, water testing certification, hazardous waste compliance certification, radiation compliance certification, BSL3 certification, and all other specialty equipment certification.
EH&S is provided, as applicable for project, with fume hood certification, water testing certification, hazardous waste compliance certification, radiation compliance certification, BSL3 certification, and all other specialty equipment certification.

### PM notifies University Risk Management that project is transferring to University and notifies Contractor that it can eliminate Builders Risk Insurance.
PM notifies University Risk Management that project is transferring to University and notifies Contractor that it can eliminate Builders Risk Insurance.

### Elevator tools, including hand tools, computer, proprietary and operational software is received and confirm 1-year service from date of acceptance.
Elevator tools, including hand tools, computer, proprietary and operational software is received and confirm 1-year service from date of acceptance.

### All computers and software required in drawings and specs. are received, including for BAS, Energy and Lighting, Fuel Systems, and Power Management, and any specialty software and alarm codes for operating systems.
All computers and software required in drawings and specs. are received, including for BAS, Energy and Lighting, Fuel Systems, and Power Management, and any specialty software and alarm codes for operating systems.

### For all areas to be transferred to University, all waste and debris removed; floor and wall surfaces clean and in good repair; ceiling surfaces clean, unmarked, in place; site, including sidewalks, cleared of debris and construction equipment; and roof is clear of all materials and debris.
For all areas to be transferred to University, all waste and debris removed; floor and wall surfaces clean and in good repair; ceiling surfaces clean, unmarked, in place; site, including sidewalks, cleared of debris and construction equipment; and roof is clear of all materials and debris.

### Water chlorination and testing complete and provided by PM to Chief Building Official and BMO via BMO Rep.
Water chlorination and testing complete and provided by PM to Chief Building Official and BMO via BMO Rep.

### Toilet accessories are in place that meet custodial contract.
Toilet accessories are in place that meet custodial contract.

### Trash receptacles outside the building are in place
Trash receptacles outside the building are in place

---

*Highlighted items are not the responsibility of Contractor but PM and BMO Rep must ensure these are completed and operational prior to occupancy and use.*
Mark N/A by item if it is not applicable to project

3.1.12

---

<table>
<thead>
<tr>
<th>University Project Manager (sign &amp; print name)</th>
<th>Date</th>
<th>University BMO Rep. (sign &amp; print name)</th>
<th>Date</th>
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<table>
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<tr>
<th>University FSS Rep (sign &amp; print name)</th>
<th>Date</th>
<th>University Downtown Rep. (If Necessary) (sign &amp; print name)</th>
<th>Date</th>
</tr>
</thead>
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</table>
Supplemental Building / Project Acceptance List

Project Name & Number: ____________________________________________________________
Contractor: ___________________________________________________________________

In addition to completing Pre-Acceptance Checklist (SBP-05), the following items must be completed before Final Acceptance.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date Completed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Review State Buildings Pre-Acceptance check list &amp; Notice of Approval of Occupancy / use form with BMO rep &amp; confirm agreement with status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*2. Establish list of post construction change orders &amp; track separately from basic project until items are complete – call it Phase 2 to avoid delay on basic project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. O &amp; M Manuals given to BMO Representative and BMO Archivist (2 hard copies and 1 electronic total)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*4. Record Documents – a hard copy of plans and specifications are provided for plan room &amp; given to BMO &amp; electronic auto cad &amp; specs are given to Archive Officer (Art Steinman) this is to include landscape drawings showing irrigation installation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*5. Final Site Walk is completed with University Grounds Supervisor. Drain barriers are removed and storm drains cleared. MS4 storm water plan, CDPHE permits, and evidence of final closeout received by Project Manager and all copied to University Engineering Division.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*/**6. Move-related work items complete including physical move, tours (occupants &amp; police), mail, phone &amp; electrical hook ups for equipment &amp; furniture systems complete &amp; freezers enrolled in University freezer program.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. If exterior work is applicable: Landscape – Include a walk through with University Grounds for 1) new &amp; established 1-year service date; 2) existing damaged landscape is repaired; and 3) irrigation – zone control test is complete.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Attic stock, matches spec. requirements, is located in secured location, and is inventoried.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Electrical system one line diagram framed and mounted in electrical room.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Spare fire suppression heads in cabinets and tool: cabinet in main electrical room includes one complete set of spare fuses for major equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Contractor keys issued by University BMO returned to University Key Shop via PM/ BMO Rep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Interior Finishes Binder given to the University Project Manager: (Two hard copies)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Not Used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Not Used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Safety grating in pipe chases in place.

16. Signs in place including monument sign, building exterior and site signage and building interior signage.

17. All applicable reports, including Air Emission reports; Sewer Reports, including for process diverters, traps and collection tanks; Fuel Storage Tank and Detection reports; and Water System tests and reports provided to BMO via PM and BMO Rep.

18. Not Used

19. Not Used

20. Not Used

21. Not Used

22. If commissioning is included for project, Commissioning Agent certification is received by BMO via PM and BMO Rep.

<table>
<thead>
<tr>
<th>University Project Manager</th>
<th>Date</th>
<th>University BMO Rep.</th>
<th>Date</th>
</tr>
</thead>
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<td>(sign &amp; print name)</td>
<td></td>
<td>(sign &amp; print name)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>University FSS</th>
<th>Date</th>
<th>University Downtown Rep (if necessary)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>(sign &amp; print name)</td>
<td></td>
<td>(sign &amp; print name)</td>
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</tbody>
</table>

*Warranty dates are not subject to completion of these items by contract

**Highlighted items are not the responsibility of Contractor but PM and BMO Rep must ensure these are completed and operational prior to occupancy and use.**

Mark N/A by item if it is not applicable to project

3.1.12
SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Systems, subsystems, and equipment operation and maintenance manuals.
3. Product maintenance manuals.
4. Emergency manuals.
5. Framed operating and maintenance instructions.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 01 91 13 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Schedule: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 calendar days before commencing demonstration and training. Architect/Engineer will return copy with comments.

1. Correct or revise each manual to comply with Architect/Engineer’s comments. Submit copies of each corrected manual within 15 calendar days of receipt of Architect/Engineer’s comments and prior to commencing demonstration and training.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect/Engineer.
a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Compile entirely from documents with searchable text.

c. Enable inserted reviewer comments on draft submittals.

2. Paper copies. Assemble in accordance with the requirements of this Section.

a. Submit three final copies, one to be retained by the Architect/Engineer and two to be retained by the University.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 calendar days before commencing demonstration and training. Architect/Engineer will return copy with comments.

1. Correct or revise each manual to comply with Architect/Engineer's comments. Submit copies of each corrected manual within 15 calendar days of receipt of Architect/Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of a system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Intent: Prepare data in form of an instructional manual for use by University personnel.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
C. **Title Page:** Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of University.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect/Engineer.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect/Engineer that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

D. **Table of Contents:** List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

E. **Manual Contents:** Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. **Manufacturers’ Data:** Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

G. **Drawings:** Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

H. **Manuals, Electronic Files:** Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size and enable OCR (optical character recognition) to provide searchable text.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
I. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in minimum 1 inch and maximum 2 inch thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.


   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 SYSTEMS, SUBSYSTEMS AND EQUIPMENT OPERATION AND MAINTENANCE MANUALS

A. General: Provide operation and maintenance manuals where indicated in individual Specification Section and the following:

   1. Heating, ventilating and air-conditioning equipment and systems.
   2. Plumbing equipment and systems.
   3. Special piping equipment and systems.
   4. Electrical distribution systems.
   5. Standby generator systems.
   6. Communications systems.
   7. Fire alarm and detection systems.
   8. Underground sprinkler systems.
  10. Food service equipment.
  11. Elevators.
  12. Other special construction and conveying systems.

B. Operation Content: In addition to requirements in this Section, include operation data required in individual Specification Sections.

   1. Additional Operation Content Required:
b. Performance and design criteria if Contractor has delegated design responsibility.
c. Operating standards.
d. Operating procedures.
e. Operating logs.
f. Wiring diagrams.
g. Control diagrams.
h. Piped system diagrams.
i. Precautions against improper use.
j. License requirements including inspection and renewal dates.

2. Descriptions: Include the following:

   a. Product name and model number. Use designations for products indicated on Contract Documents.
b. Manufacturer's name.
c. Equipment identification with serial number of each component.
d. Equipment function.
e. Operating characteristics.
f. Limiting conditions.
g. Performance curves.
h. Engineering data and tests.
i. Complete nomenclature and number of replacement parts.

3. Operating Procedures: Include the following, as applicable:

   a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Instructions on stopping.
f. Normal shutdown instructions.
g. Seasonal and weekend operating instructions.
h. Required sequences for electric or electronic systems.
i. Special operating instructions and procedures.

4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.


C. Maintenance Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below:

1. Source Information: Provide the following information in a list for each product included in manual:

   a. Name, address, and telephone number of Installer or supplier and maintenance service agent.
b. Name, address, and telephone number of local source for supply of replacement parts.
c. Name, address, and telephone number of maintenance contractor, where appropriate.
d. Cross-reference Specification Section number and title.
e. Drawing or schedule designation or identifier where applicable.
2. Manufacturers’ Maintenance Documentation: Manufacturers’ maintenance documentation including the following information for each component part or piece of equipment:
   a. Standard maintenance instructions and bulletins.
   b. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   c. Identification and nomenclature of parts and components.
   d. List of items recommended to be stocked as spare parts.

3. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   a. Test and inspection instructions.
   b. Troubleshooting guide.
   c. Precautions against improper maintenance.
   d. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   e. Aligning, adjusting, and checking instructions.
   f. Demonstration and training video recording, if available.

4. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   b. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

5. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

6. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

7. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   a. Include procedures to follow and required notifications for warranty claims.
   b. Include information sheet covering proper procedures in event of failure and instances which might affect validity of warranties and bonds.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Separate into two manuals: one for exterior moisture protection products and those exposed to weather and one for interior products. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: Provide the following information for each product included in manual:
   1. Name, address, and telephone number of Installer or supplier and maintenance service agent.
   3. Drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.5 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
5. Power failure.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of University's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.
2.6 Framed Operating and Maintenance Instructions

A. All mechanically and electrically operated equipment and controls shall be provided with legible and complete wiring diagrams, schematics, operating instructions, and pertinent preventative maintenance instructions in a sturdy frame with clear glass or plastic cover. Use non-fading, permanent media.

B. Locate frames in the same room or service enclosure as equipment, or in the nearest mechanical or electrical room.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Record Samples.
5. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 73 00 "Execution" for final property survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. General: Submit record drawings with duplicate original transmittal letters containing:

1. Date.
2. Project title and number.
3. Contractor’s name and address.
4. Certification that each document as submitted is complete and accurate.
5. Signature of authorized representative of the Contractor.

B. Record Drawings: Submit copies of record Drawings as follows:

1. Submit three paper-copy sets of marked-up record prints, two copies will be retained by the University and one copy retained by the Architect/Engineer.
2. Submit three paper-copy sets and three digital copies on CD of electronic files for all delegated-design submittals. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

C. Record Specifications: Submit three paper copies of Project's Specifications, including addenda and contract modifications. Two copies will be retained by the University and one copy retained by the Architect/Engineer.
D. Record Product Data: Submit three paper copies of each submittal. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit three paper copies of each submittal. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

F. Interior Finishes Binder: Three copies. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding archive photographic documentation.
   f. Mark using line types and symbols conforming to Contract Documents.

2. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities referenced to permanent surface improvements.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities referenced to visible and accessible features of structure.
   j. Locations of concealed valves, dampers, controls, balancing devices, junction boxes, cleanouts, and other items requiring access or maintenance.
   k. Changes made by Change Order.
   l. Changes made following Architect/Engineer's written orders.
   m. Details not on the original Contract Drawings.
   n. Field records for variable and concealed conditions.
o. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark additional information important to University that was either shown schematically or omitted from original Drawings.

6. Note Change Order numbers, and similar identification, where applicable.

B. Record Delegated Design Electronic Files: For all delegated design submittals, including but not limited to landscape irrigation, fire alarm and fire sprinkler plans, prepare electronic files in full compliance with University of Colorado Denver | Anschutz Medical Campus Guidelines and Design Standards, Part 1.0, Paragraph “Drawing Production Standards.”

C. Identification: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect/Engineer.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to substitutions, selection of options, and similar information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Note related Change Orders where applicable.

4. Maintain one complete copy of all Addenda, Change Orders and other written change documents in printed form during construction.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Directory: Include record Product Data directory organized by Specification Section number and title.
C. Product List: Update and record any changes to Product List submitted in accordance with Section 01 60 00 “Product Requirements”, including any changes to brand, model, subcontractor, or Installer so that final list reflects materials, equipment and systems incorporated into the Work.

2.4 RECORD SAMPLES

A. Prior to Final Acceptance, meet with University Project Manager and Architect/Engineer at site to review and identify which submitted samples maintained during the progress of the Work are to be transmitted to the University.

B. Deliver selected samples to storage area identified by University.

C. Finishes Binder: Three-ring notebook or notebooks, organized by Specification Section number, providing a listing and description of all material finishes on the Project and including a minimum 6 inch by 6 inch sample thereof to accompany the description. Accompany each material selection indicated with the following:

1. Manufacturer and product name.
2. Pattern name and number, as applicable.
3. Color name, as applicable.
4. Any additional information required to order replacement product.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1. Include manufacturer’s certifications, field test record, copies of permits, licenses, certifications, inspection reports, releases, notices, receipts for fee payments and similar documents.

B. Directory: Include miscellaneous record submittals directory organized by Specification Section number and title.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project. Update at least weekly.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect/Engineer’s and University’s reference during normal working hours.

END OF SECTION 01 78 39
SECTION 01 78 46
EXTRA STOCK MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes descriptions and quantities of required extra stock materials.

1.3 INFORMATIONAL SUBMITTALS
A. Schedule of Maintenance Materials: Prepare a schedule in tabular form of all extra stock materials required in individual Specification Sections including:

1. Specification Section number and title.
2. Description of required material
3. Quantity of required material.

1.4 MAINTENANCE MATERIALS
A. Furnish extra materials that match and are from the same production runs as the product installed.
B. Provide in the quantities indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 MAINTENANCE MATERIAL SCHEDULE

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>04 42 00</td>
<td>EXTERIOR STONE</td>
<td>Dimension Stone Units</td>
<td>Furnish 100 sq. ft. finished stone panels for each finish and variety of stone specified.</td>
</tr>
<tr>
<td></td>
<td>CLADDING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 30 00</td>
<td>TILING</td>
<td>Tile and Trim Units</td>
<td>Furnish 100 sq. ft. of full-size units for each type, composition, color, pattern, and size indicated.</td>
</tr>
<tr>
<td>09 30 33</td>
<td>STONE TILING</td>
<td>Dimension Stone Tile</td>
<td>Furnish 100 sq. ft. of full-size units for</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Details</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>09 51 13</td>
<td>ACOUSTICAL PANEL CEILINGS</td>
<td>Acoustical Ceiling Panels, 100 sq. ft. of full-size panels.</td>
<td></td>
</tr>
<tr>
<td>09 51 23</td>
<td>ACOUSTICAL TILE CEILINGS</td>
<td>Acoustical Ceiling Units, 100 sq. ft. of full-size tiles.</td>
<td></td>
</tr>
<tr>
<td>09 54 36</td>
<td>SUSPENDED DECORATIVE GRIDS</td>
<td>Suspended Decorative Grids, 100 sq. ft. of each suspended decorative grid component, exposed molding, and trim.</td>
<td></td>
</tr>
<tr>
<td>09 62 29</td>
<td>CORK FLOORING</td>
<td>Cork Flooring, Furnish 1 box of each type, shade, pattern, and finish of cork flooring installed.</td>
<td></td>
</tr>
<tr>
<td>09 65 13</td>
<td>RESILIENT BASE AND ACCESSORIES</td>
<td>Furnish 50 linear feet of each type, color, pattern, and size of wall base installed. Furnish 2% of each type, color, pattern, and size of all other resilient accessories installed.</td>
<td></td>
</tr>
<tr>
<td>09 68 13</td>
<td>TILE CARPETING</td>
<td>Carpet Tile, 100 sq. ft. of full-size units for each type indicated.</td>
<td></td>
</tr>
<tr>
<td>10 13 00</td>
<td>DIRECTORIES</td>
<td>Message Strips, Full-size, blank strips equal to 10 percent of amount installed for each size indicated, but no fewer than 20 strips.</td>
<td></td>
</tr>
<tr>
<td>11 12 00</td>
<td>PARKING CONTROL EQUIPMENT</td>
<td>Gate Arms, 1 breakaway gate arms for each gate installed, complete with accessory components.</td>
<td></td>
</tr>
<tr>
<td>12 21 13</td>
<td>HORIZONTAL LOUVER BLINDS</td>
<td>Horizontal Louver Blinds, Full-size units equal to 1 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units and no more than five units.</td>
<td></td>
</tr>
<tr>
<td>14 20 00</td>
<td>ELEVATORS</td>
<td>2 sets of complete parts catalogs including manufacturer’s recommended spare parts list with clear identification and illustration of each functional part, exploded parts views, identification of part numbers and assembly numbers including replaceable electrical and electronic parts and circuit boards.</td>
<td></td>
</tr>
<tr>
<td>21 05 00</td>
<td>FIRE SUPPRESSION</td>
<td>Sprinkler heads and Special Sprinkler Wrenches. 2 heads, maximum of each type and temperature rating installed and special sprinkler wrenches enclosed in a steel cabinet in accordance with NFPA 13.</td>
<td></td>
</tr>
<tr>
<td>22 30 00</td>
<td>PLUMBING EQUIPMENT</td>
<td>Valve Key, 1 valve key for each key operated wall hydrant, post hydrant, hose bib, or faucet installed.</td>
<td></td>
</tr>
<tr>
<td>23 05 13</td>
<td>MOTORS</td>
<td>Variable Frequency Drives, 1 complete set of spare fuses for each VFD supplied.</td>
<td></td>
</tr>
<tr>
<td>23 30 00</td>
<td>HVAC AIR DISTRIBUTION</td>
<td>Fire Dampers, 3 fusible links per type installed.</td>
<td></td>
</tr>
<tr>
<td>23 57 00</td>
<td>HEAT EXCHANGERS FOR HVAC</td>
<td>Heat Exchanger, 1 gasket for each flanged connection for each heat exchanger installed.</td>
<td></td>
</tr>
<tr>
<td>23 65 00</td>
<td>COOLING TOWERS</td>
<td>COOLING TOWERS, 3 spray nozzles for each tower cell provided. 1 gasket for each gasketed access and inspection opening provided.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Category</td>
<td>Description</td>
<td></td>
</tr>
<tr>
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<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>23 70 00</td>
<td>CENTRAL HVAC EQUIPMENT</td>
<td>Air Handling Units, 1 set of matched fan belts for each belt driven fan provided.</td>
<td></td>
</tr>
<tr>
<td>26 09 43</td>
<td>NETWORK LIGHTING CONTROLS</td>
<td>Control Devices, 1 set of belts for each unit installed with label clearly identifying to which fan the belt belongs.</td>
<td></td>
</tr>
<tr>
<td>26 20 00</td>
<td>LOW VOLTAGE ELECTRICAL DISTRIBUTION</td>
<td>Fuses, 1 set of 3 of each type and size used on the project and fuse cabinet in main electrical room to hold them.</td>
<td></td>
</tr>
<tr>
<td>26 51 00</td>
<td>INTERIOR LIGHTING</td>
<td>Lamps, Provide 5% or a maximum of 25 spares of each lamp type used on the project.</td>
<td></td>
</tr>
<tr>
<td>28 31 00</td>
<td>FIRE DETECTION AND ALARM</td>
<td>Initiating and Control Devices, Provide 5 spare devices for each device type used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Notification Devices</td>
<td>Provide 5 spare devices for each device type used.</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION 01 78 46
SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing University’s personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include outline for each training module.

B. Qualification Data: For instructor, demonstrating qualifications and ability to instruct on maintenance and care of system, equipment and products.

C. Schedule of Demonstration and Training: Prepare a schedule in tabular form of all demonstration and training required in individual Specification Sections including:

1. Specification Section number and title.
2. Description of required demonstration and training.

D. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training. Manufacturer’s sales staff is not acceptable.

B. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.
PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
   g. A tour of the installation identifying the location of all system components.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.
n. Sequence of operation.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.
   f. Product support/service model.
   g. Purchasing of replacement parts.

9. Instruction specific to Instrumentation and Controls, Electrical Gateway, Network Lighting Controls, or any other new technology that is integrated with another system: Include the following:
   a. Overview and theory.
   b. Wiring diagrams, including the one line diagram.
   c. Creation, editing, and programming of the point database.
   d. Integration topology and platform for communication.
   e. Graphics packages and touch screens for the system.
   f. Alarms and diagnostics.
   g. Reporting functions dynamically and historically.
   h. Remote access to the system.
   i. Database back-up and maintenance.
   j. Replacement and re-programming of replacement parts.
   k. Point type and functionality for each type of point.
   l. Programming.
   m. Point/object editing.
   n. Loop tuning.
   o. Help files and other troubleshooting documentation.
p. Instruction is given by the staff that setup the integration.

C. Operation and Maintenance Manuals: Provide appropriate Operation and Maintenance manuals in each training session so that the detail drawings and maintenance activities are outlined and discussed for each application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct University's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. University will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Coordinate schedule for all training with University Project Manager and provide the following:

   a. Minimum 3 weeks notification.
   b. Training matrix in calendar format.
   c. Training outline for each session.

2. Do not schedule training until equipment has been started up, commissioned, and is currently operating in its normal condition.

3. Do not schedule overlapping training sessions.

4. Schedule training sessions for a maximum of 4 hours per day; afternoons preferred.

5. Provide separate training session on each system for operational/maintenance groups and user groups.

6. Training sessions will be cancelled and rescheduled unless the following documentation is received:

   a. Instruction qualifications.
   b. Evidence that equipment has been started up, commissioned, and is currently operating in its normal condition.
   c. Operation and Maintenance manuals.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Travel, Room and Board: Coordinate any out-of-state training with the University Project Manager.

E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.
### DEMONSTRATION SCHEDULE

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 42.29.33</td>
<td>SWINGING AUTOMATIC ENTRANCES</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain automatic entrances.</td>
</tr>
<tr>
<td>10 11 00</td>
<td>VISUAL DISPLAY SURFACES</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain motor-operated, sliding visual display units.</td>
</tr>
<tr>
<td>10 22 38</td>
<td>OPERABLE PANEL PARTITIONS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain operable panel partitions.</td>
</tr>
<tr>
<td>10 55 00</td>
<td>POSTAL SPECIALTIES</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain postal specialties.</td>
</tr>
<tr>
<td>11 12 00</td>
<td>PARKING CONTROL EQUIPMENT</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain parking control equipment.</td>
</tr>
<tr>
<td>11 13 00</td>
<td>LOADING DOCK EQUIPMENT</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain loading dock equipment.</td>
</tr>
<tr>
<td>11 14 00</td>
<td>FOOD SERVICE EQUIPMENT</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain foodservice equipment.</td>
</tr>
<tr>
<td>11 82 26</td>
<td>FACILITY WASTE COMPACTORS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain waste compactors according to manufacturer's requirements and ANSI Z245.2.</td>
</tr>
<tr>
<td>12 21 13</td>
<td>HORIZONTAL LOUVER BLINDS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain systems.</td>
</tr>
<tr>
<td>12 24 13</td>
<td>ROLLER WINDOW SHADES</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain motor-operated roller shades.</td>
</tr>
<tr>
<td>13 20 00</td>
<td>SPECIAL PURPOSE ROOMS</td>
<td>Engage a factory-authorized service representative to train and provide training video to University’s maintenance personnel to operate, adjust, maintain, and repair controlled environmental rooms and cold rooms.</td>
</tr>
<tr>
<td>14 21 00</td>
<td>ELECTRIC TRACTION ELEVATORS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to operate, adjust, and maintain elevator(s).</td>
</tr>
<tr>
<td>Time</td>
<td>Category</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>14 21 13</td>
<td>ELECTRIC TRACTION FREIGHT ELEVATORS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to operate, adjust, and maintain elevator(s).</td>
</tr>
<tr>
<td>14 24.00</td>
<td>HYDRAULIC ELEVATORS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to operate, adjust, and maintain elevator(s).</td>
</tr>
<tr>
<td>14 24 13</td>
<td>HYDRAULIC FREIGHT ELEVATORS</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to operate, adjust, and maintain elevator(s).</td>
</tr>
<tr>
<td>23 00 00</td>
<td>HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)</td>
<td>Schedule instructional meetings for The University of Colorado Anschutz Medical Campus Facilities Operations maintenance personnel on the proper operation and maintenance of mechanical systems. Provide the project manager a minimum of 5 days notice prior to any testing.</td>
</tr>
<tr>
<td>23 05 13</td>
<td>MOTORS</td>
<td>Engage a factory-authorized representative to train the University’s representative for 2 hours for each variable frequency drive installed. Training includes startup, shutdown, emergency operation, maintenance and servicing.</td>
</tr>
<tr>
<td>23 08 00</td>
<td>COMMISSIONING OF HVAC</td>
<td>Engage the commissioning authority to provide a customized one to two day training class for the university’s engineering personnel in problem solving techniques including the review of mechanical system design as a whole, integrated unit, unique qualities of the installed mechanical system, insights into how to solve system-wide, multi-faceted problems, and identify a variety of resources to assist with problem solving.</td>
</tr>
<tr>
<td>23 09 00</td>
<td>INSTRUMENTATION AND CONTROLS</td>
<td>Engage a factory-authorized trained representative to conduct a minimum of 1-four hour on-site training course and an additional 1-four hour on-site training course per 25,000 sq. ft. for designated University personnel. Engage a factory-authorized trained representative to conduct an 8-hour seasonal loop training.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide 40 hours of certified training in Instrument and Controls for every 100,000 sq. ft. of a lab/research building.</td>
</tr>
<tr>
<td>23 11 13</td>
<td>FACILITY FUEL-OIL PIPING</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain liquid-level gage systems, leak-detection and monitoring systems, and fuel-oil pumps.</td>
</tr>
<tr>
<td>23 21 23</td>
<td>PUMPS</td>
<td>Engage a factory-authorized service representative to train a University Representative for 2 hours of instruction for each pumping system provided.</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Description</td>
</tr>
<tr>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>23 25 13</td>
<td>CHEMICAL WATER TREATMENT</td>
<td>Engage a factory-authorized service representative to train operating personnel for 8 hours to familiarize them with all treatment equipment and procedures. Include procedure for taking weekly water test on open-loop systems and the application and safe handling of supplied chemicals.</td>
</tr>
<tr>
<td>23 64 16</td>
<td>CENTRIFUGAL WATER CHILLERS</td>
<td>Engage a factory-authorized service representative to train the University’s representative for 4 hours including the operation of chillers, accessories and controls, procedures for startup and shutdown, troubleshooting, servicing, preventative maintenance, and review of the maintenance manuals.</td>
</tr>
<tr>
<td>23 65 00</td>
<td>COOLING TOWERS</td>
<td>Engage a factory-authorized service representative to train the University’s personnel for one, 8-hour day, for operation and maintenance of the cooling towers.</td>
</tr>
<tr>
<td>23 76 00</td>
<td>EVAPORATIVE COOLING EQUIPMENT</td>
<td>Engage the manufacturer’s representative to train the University’s personnel for four (4) hours. Include start-up and shutdown procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures, and the contents of the Operating and Maintenance Data.</td>
</tr>
<tr>
<td>26 00 00</td>
<td>ELECTRICAL</td>
<td>Engage a factory-authorized service representative to train the University’s Operations personnel a minimum of 8 hours for each system. Provide an additional minimum of 4 hours for any electrical gateway or networked lighting controls.</td>
</tr>
<tr>
<td>26 56 00</td>
<td>EXTERIOR LIGHTING</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain luminaire lowering devices.</td>
</tr>
<tr>
<td>28 31 00</td>
<td>FIRE DETECTION AND ALARM</td>
<td>Engage a factory-authorized service representative to train the University’s Operations personnel a minimum of 8 hours for each system.</td>
</tr>
<tr>
<td>32 84 00</td>
<td>PLANTING IRRIGATION</td>
<td>Engage a factory-authorized service representative to train University’s maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.</td>
</tr>
</tbody>
</table>

END OF SECTION 01 79 00
SECTION 02 81 00
TRANSPORTATION/DISPOSAL OF HAZARDOUS MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides standards discovery, abatement, disposal, and worker protection for all hazardous materials including asbestos, lead, polychlorinated biphenyls (PCBs), mercury, radioactive materials, and mold.

B. All hazardous materials and waste must be managed and coordinated with Environmental Health and Safety (EHS) through the University Project Manager.

1.2 REFERENCES

A. Occupational Safety and Health Administration, 29 CFR 1926.1101, Asbestos.


C. Environmental Protection Agency, 40 CFR 763.120, Asbestos Worker Protection Rule.


E. Environmental Protection Agency 40 CFR 261.24, Toxicity Characteristic.

F. Environmental Protection Agency, 40 CFR 262, Standards Applicable to Generators of Hazardous Waste.


H. Code of Colorado Regulation Number 8 Control of Hazardous Air Pollutants, Part B Asbestos Control, 5 CCR 1001 – 10 Part B.


J. Air Quality Control Commission (AQCC) Regulations 19 – Lead-Based Paint Abatement.


1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Performance Requirements - Asbestos

1. Presence on Campus:
   a. Asbestos is present in many building in and around the campus. Typical forms of asbestos containing materials (ACM) include pipe insulation, ceiling, wall, floor and roof materials.
   b. Investigate every project where work will occur prior to soil disturbing activities to identify asbestos containing materials (ACM). The University Project Manager is responsible for coordinating and ensuring that an inspection or review of previous surveys and any
required sampling be performed prior to finalizing the scope or work and associated budget.

c. Include the cost of investigations, sampling, waste transportation, disposal and associated costs in the cost of the project.

2. Excavation Notifications: Required as described below prior to beginning soil disturbing activities.
   a. Localized Limited Quantity Shallow Hand Digging – No notification required.
   b. Small Scale Localized Hand/Equipment Excavation – No notification required.
   c. Moderate Scale Localized Equipment Excavation – Notification to the AHEC Project Manager.
   d. Large Scale Equipment Excavation – Notification to the AHEC Project Manager.

3. Discovery of Asbestos:
   a. Notify contractors and the AHEC Campus EHS Manager via project documents to stop work when asbestos is encountered or thought to be encountered. It is the responsibility of the University Project Manager to decide what type of action will follow, in consultation with the University’s EHS Department.

4. Asbestos Removal:
   a. Perform any asbestos removal (abatement), repair, encapsulation or spill clean-up in accordance with the above referenced regulatory standards.
   b. Utilize qualified and trained personnel for abatement design and removal in accordance with the above referenced regulatory standards.

5. Asbestos Containing Waste
   a. Follow the University asbestos waste disposal guidelines and Environmental Protection Agency regulations for disposal of asbestos generated at each project.

B. Performance Requirements – Lead

1. Presence on Campus:
   a. Typical forms of lead containing materials (LCM) include paint, lead shielding materials, electronic equipment, and piping (sink traps).
   b. Consult with EHS through the University Project Manager to determine when LCM investigation is required. The University Project Manager is responsible for coordinating and ensuring that an inspection or review of previous surveys and any required sampling be performed prior to finalizing the scope or work and associated budget.
   c. Include the cost of investigations, sampling, waste transportation, disposal and associated costs in the cost of the project.

2. Discovery of Lead:
   a. Suspect LCM at all painted surfaces of older campus buildings, brick, and walls and floors in rooms designated (or previously designated) for radiography.
   b. Notify contractors and the University Project Manager via project documents when lead is encountered or thought to be encountered. It is the responsibility of the University Project Manager to consult with EHS to decide what type of action will follow.

3. Lead Renovation:
   a. Perform any renovation of lead containing materials, repair, encapsulation or clean-up in accordance with the above referenced regulatory standards.
   b. Utilize qualified and trained personnel for renovation in accordance with the above referenced regulatory standards.

4. Handling of Lead Waste:
   a. Coordinate with EHS through the University Project Manager.
   b. Include all costs associated with handling of lead waste in the Project Cost.

1.4 SUBMITTALS

A. Abatement Specifications:

1. Provide a certified asbestos project manager on all asbestos abatement projects in which the amount of friable asbestos material to be abated exceeds 1000 linear feet on pipes or 3000 square feet on other surfaces.
2. The certified asbestos project manager must prepare and approve written abatement specifications.
3. Coordinate with the University EHS Department for additional requirements per project.

B. Asbestos Waste Manifests:
   1. Prepare hazardous waste manifests for all asbestos waste shipments associated with University asbestos related projects. Submit copies and originals of these manifests in sequential (numerical) order to the University.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 23 00
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements:
   1. Concrete mixtures for concrete slabs and concrete deck fill shall be normal weight and shall have a water-cement ratio of 0.45 or less.
   2. Provide sheet vapor retarder directly below concrete at all slabs-on-grade.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Materials:
   1. Portland Cement Replacement: Fly ash to reduce portland cement up to 40 percent is acceptable for concrete mixtures for footings, foundation walls, walls, columns, and other vertical surfaces; not permitted for slabs.

B. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 mil, except with maximum perm rating of 0.01. Include manufacturer's recommended adhesive or pressure-sensitive tape. Provide at all slabs-on-grade.

C. Penetrating Liquid Floor Treatments: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Provide at loading docks, receiving areas, and other similar exposed concrete floor surfaces subject to heavy, hard-wheeled devices.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor and Slab Finishes:
   1. Trowel: Surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or thin-film-finish coating system.

3.2 FIELD QUALITY CONTROL

A. Testing: By The University-engaged agency.

B. Special Inspections: By The University-engaged special inspector.

C. Cost of Testing: To be included as part of Project budget.

END OF SECTION 03 30 00
SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements
1. Wood studs not permitted. If required and approved by the University Project Manager provide fire-retardant-treated lumber.
2. Select composite wood products with low emissions based on ASTM testing standards E1333-10.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Products, General:
1. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness.

B. Wood-Preservative-Treated Materials:
1. Preservative Treatment: AWPA U1; use Category UC2 except use Category UC3b for exterior construction and use Category UC4a for items in contact with the ground.
   a. Preservative Chemicals: Containing no arsenic or chromium.
2. Application: Items indicated and the following:
   a. Items in contact with roofing or waterproofing.
   b. Items in contact with concrete or masonry.
   c. Framing less than 18 inches above ground in crawlspace.
   d. Floor plates installed over concrete slabs-on-grade.

C. Fire-Retardant-Treated Materials:
1. Exterior type for exterior locations and where indicated.
2. Interior Type A, High Temperature (HT) for enclosed roof framing and where indicated.
3. Interior Type A unless otherwise indicated.

D. Miscellaneous Lumber:
1. Dimension Lumber: Construction or No. 2 grade any species.

E. Plywood Backing Panels: Exterior, AC, fire-retardant treated.

F. Fasteners: Hot-dip galvanized steel where exposed to weather, in ground contact, in contact with treated wood, or in area of high relative humidity.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 06 10 53
SECTION 06 16 00

SHEATHING

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wall Sheathing:

B. Wood Sheathing: Plywood, oriented-strand board, fiberboard or any wood-based sheathing products are not permitted unless fire retardant treated.

C. Miscellaneous Materials:
   1. Sealant for gypsum sheathing.
   2. Sheathing tape.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gypsum Sheathing:
   1. Screw to cold-formed metal framing.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00
SECTION 06 20 23

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Shelving: MDO plywood with wood edge; AWI custom grade; 1 inch thick minimum.

B. Shelving Standards: Provide standard-duty except where heavier loads are anticipated.
   1. Standard-duty standards: BHMA A156.9, B4102
      a. Basis-of Design Product: Subject to compliance with requirements, provide Knape & Vogt
         80 Series Standard System or comparable product.
   2. Standard-duty brackets: BHMA A156.9, B4112
      a. Basis-of Design Product: Subject to compliance with requirements, provide Knape & Vogt
         180 Series Bracket System comparable product.
   3. Heavy-duty standards: BHMA A156.9, B4102
      a. Basis-of Design Product: Subject to compliance with requirements, provide Knape & Vogt
         85 Series Standard System or comparable product.
   4. Heavy-duty brackets: BHMA A156.9, B4112
      a. Basis-of Design Product: Subject to compliance with requirements, provide Knape & Vogt
         185 Series Bracket System comparable product.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 06 20 23
SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 EXTENDED WARRANTY: Provide a written two-year warranty, signed by Contractor and sealant installer, guaranteeing all exterior joints and interior joints detailed within the Vivarium to be water and air tight for a period of not less than two (2) years from date of the Letter of Acceptance of the Work by the University.

1. Exception: Provide 20 year warranty period from date of the Letter of Acceptance of the Work by the University for sealants used in BSL3 only.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Use: For joints in vertical surfaces.

2. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; 790.
   b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
   c. Tremco Incorporated; Spectrem 1.

B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Use: For joints in restrooms, janitor’s closets, and other areas subject to continued moisture exposure or high humidity, including door frames and all static joints in ABSL and animal facilities.

2. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Building Systems; Omniplus.
   b. Dow Corning Corporation; 786 Mildew Resistant.
   c. GE Advanced Materials - Silicones; Sanitary SCS1700.
   d. Tremco Incorporated; Tremsil 200 Sanitary.

C. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Use: For interior door frames and other static joints.

2. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Building Systems; Sonolac.
   c. Pecora Corporation; AC-20+.
   d. Tremco Incorporated; Tremflex 834.

D. Acoustical Joint Sealant: Nonsag, paintable, nonstaining latex.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pecora Corporation; AC-20 FTR.
   b. USG Corporation; SHEETROCK Acoustical Sealant.

E. Cylindrical Joint-Sealant Backing: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
PART 3 - EXECUTION

END OF SECTION 07 92 00
SECTION 09 00 00

FINISHES

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements:
   1. Interior design color palette proposed by the Design Professional must meet all criteria established with input and approval by the University Campus Architect through the University Project Manager.
   2. Provide rubber base at both carpet and resilient flooring installations. Upgrades are permissible with approval of the University Campus Architect through the University Denver Project Manager.
   3. All penetrations and/or seams in materials in BSL3, Vivaria, and other similar functional areas are to be sealed, unless otherwise noted.

B. Performance Requirements:
   1. Fire-Test-Response Characteristics:
      a. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
         1) Flame-Spread Index: 25 or less.
         2) Smoke-Developed Index: 25 or less.
         3) Fuel Contributed Index: 15 or less.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION OF CONCRETE TO RECEIVE MOISTURE SENSITIVE FLOORING

A. Prepare all concrete substrates to receive moisture sensitive floor finishes including, but not limited to, resilient sheet floor, linoleum flooring, resilient tile flooring, resinous matrix terrazzo flooring, resinous flooring, sheet carpeting and tile carpeting, according to ASTM F 710 and the following:
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate pH is between 7.0 and 9.0.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.

B. Provide moisture vapor emissions and alkalinity control system to all concrete substrates that fail alkalinity and/or moisture testing.

END OF SECTION 09 00 00
SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements:
   1. Space studs at 16 inches on center maximum.
   2. Where interior partitions do not extend to the underside of structure, extend partition 6” above the ceiling grid and brace to structure at 4 feet on center.

B. Performance Requirements:
   1. Partitions, General: Provide metal framing systems of base-metal thickness and spacing capable of limiting lateral deflections when subjected to a 5 psf uniform lateral load to the following:
      a. L/240 where supporting gypsum board only.
      b. L/360 where supporting plaster or ceramic tile finishes.
      c. L/720 where providing backup to stone or masonry.
   2. Partitions Enclosing Pressurized Mechanical Rooms: Provide metal framing systems of base-metal thickness and spacing capable of limiting lateral deflections to L/240 when subjected to a 15 psf uniform lateral load or the design value induced by the mechanical system, whichever is greater.
   3. Suspended Ceiling Design Requirements: Provide metal framing systems of base-metal thickness and spacing capable of limiting ceiling deflections to L/360 when subjected to a minimum 4 psf uniform load or the actual weight of ceiling hung materials, whichever is greater.
   4. Engineering design of non-structural metal framing by Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Framing for Framed Assemblies:
   1. Steel studs and runners: 0.033-inch-thick (20 gauge) minimum.
   2. Dimpled steel studs and runners: 0.025-inch-thick minimum, with structural properties equivalent to 0.0329-inch-thick steel studs.

PART 3 - EXECUTION (Not Applicable)

3.1 INSTALLATION

A. Secure with fasteners or proper crimping tools; do not weld.

END OF SECTION 09 22 16
SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements
   1. Design all walls within a vivarium to have a sound transmission class (STC) rating of 55 or better.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Interior Gypsum Board:
   1. Gypsum board, Type X: Provide 5/8 inch thick, typical unless noted otherwise.
   2. Abuse-resistant gypsum board: Provide at service corridors.
   3. Moisture- and mold-resistant gypsum board. Provide at all high humidity areas.

B. Exterior Gypsum Board for Ceilings and Soffits:

C. Tile-Backing Panels:
   1. Glass-mat, water-resistant backing board.

D. Trim Accessories:
   2. Exterior: Hot-dipped galvanized steel sheet or rolled zinc.

E. Auxiliary Materials
   1. Sound attenuation blankets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Finishing Gypsum Board Assemblies:
   1. Levels of Gypsum Board Finish: At a minimum, comply with recommendations in GA-214, “Recommended Levels of Gypsum Board Finish.”

   END OF SECTION 09 29 00
SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirement:
1. Provide patterns, colors and finishes approved by the University Campus Architect through the University Project Manager.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acoustical Ceiling Panels: Fire-resistance rated where required; ASTM E 1264.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong World Industries, Inc.
   b. CertainTeed Corp.
   c. USG Interiors, Inc.
2. Type and Form for typical installations: Type III, Form 1, nodular; sag resistant with anti-microbial treatment.
3. Type and Form for Laboratories: Type IV, mineral base with membrane overlay; Form 2, water felted; with fiberglass-fabric face; sag resistant with anti-microbial treatment.
5. LR: Approximately 0.90.
6. NRC: Approximately 0.70.
7. CAC: Approximately 35.
8. Thickness: 3/4 inch.
9. Modular Size: 24 by 24 inches or 24 by 48 inches scored to look like 24 by 24 inches.

B. Metal Suspension Systems: ASTM C 635.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong World Industries, Inc.
   b. CertainTeed Corp.
   c. Chicago Metallic Corporation.
   d. USG Interiors, Inc.
2. Wire hangers, braces, and ties.

C. Metal Edge Moldings and Trim: Roll-formed sheet metal.

D. Ceiling Panel Plenum Access, Identification Markings:
1. Removable ceiling tiles may provide access to mechanical and electrical components located above the ceiling. Where required, mark ceiling panel with colored map tacks glued in place according to the following:
   a. Waste Valves and Unions: Blue.
   b. Waste Cleanouts: Black.
   c. Ventilation Test Areas and Dampers: Purple.
d. Fire Dampers or Fire Detectors: Red.
e. Electrical transformers or resistance heaters: Orange.
f. Natural Gas, Oxygen, and Steam Valves or Unions: Yellow.
g. Nitrogen, Compress Air, and Vacuum Valves or Unions: Green.
h. Miscellaneous Mechanical Items: Gray.

PART 3 - EXECUTION

3.1 INSTALLATION


END OF SECTION 09 51 13
SECTION 09 61 19

VAPOREMISSION AND ALKALINITY CONTROL FLOORING TREATMENT

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements
   1. Test all concrete substrates scheduled to receive moisture sensitive flooring.
   2. Provide vapor emission and alkalinity control flooring treatment at all concrete substrates which
      fail testing criteria indicated in Section 09 00 00 “Finishes” of this guideline.
   3. In Section 01 21 00 “Allowances” specify a quantity allowance for the provision of vapor
      emission and alkalinity control flooring treatment equal to 35 percent of all concrete substrates
      scheduled to receive moisture sensitive flooring.
   4. In Section 01 20 00 “Unit Prices” require that Contractor provide a unit price bid on a per square
      foot basis for the provision of the specified vapor emission and alkalinity control flooring
      treatment including floor preparation and installation complete.

PART 2 - PRODUCTS

2.1 MOISTURE-RESISTANT FLOORING TREATMENT

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Ardex Engineered Cements; ARDEX MC, Moisture Control System.
   2. Floor Seal Technology, Inc.; Moisture Reduction System, MES 100.

B. System Description:
   1. Two component resinous treatment system, VOC compliant, low viscosity and elastomeric
      properties to expand and contract with limited slab movement. Formulated to saturate concrete
      surfaces and mechanically restrict moisture and alkalinity levels.

C. System Physical Properties: Provide resinous flooring treatment with the following minimum physical
   properties when tested according to test methods indicated:
   1. Water Vapor Transmission: Varies, 94% reduction per ASTM E 96.
   2. Alkalinity Resistance: Passes up to a pH of 14 per ASTM D 1308.
   3. Adhesion Strength: 500 psi minimum per ASTM D 4541.
   4. Relative Humidity Resistance: 100% per ASTM F 2170.
   5. VOC: Less than 100 g/L per SCAQMD Rule #1113.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Scarify slab surface in area of application by shot blasting or other method acceptable to coating
   treatment manufacturer.

B. Apply coating in strict compliance with manufacturer’s installation instructions.
SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.1 RESILIENT BASE AND ACCESSORIES

A. Resilient Base:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johnsonite.
   b. Musson, R.C. Rubber Co.
   c. Roppe Corporation, USA.
3. Style: Cove at all locations.
4. Minimum Thickness: 0.125 inch.
5. Height: 4 inches.

B. Resilient Molding Accessory: Rubber.
1. Edge Strips: 0.125 inch thick, 1 inch wide, with tapered or bullnose edge.

C. Abrasive Strips: Self-adhesive, 1 inch wide, with aluminum oxide grit.

2.2 RESILIENT TILE

A. Vinyl Composition Floor Tile:
1. Class: Through pattern.
2. Wearing Surface: Smooth.
3. Thickness: 0.125 inch.
4. Size: 12 by 12 inches.

2.3 RESILIENT SHEET FLOORING

A. Vinyl Sheet Floor Covering: ASTM F 1303, Type I, Grade 1, with Class B backing.
1. Thickness: 0.080 inch thick.
2. Wearing Surface: Smooth.
3. Sheet Width: As standard with manufacturer.
1. Seaming Method: Heat welded at medical labs (BSL2); standard otherwise.

B. Linoleum Floor Coverings:
1. Sheet Flooring: In manufacturer’s standard length by not less than 78 inches wide.
2. Seaming Method: Heat welded at medical labs (BSL2); standard otherwise.
3. Thickness: 0.08 inch.

2.4 INSTALLATION MATERIALS

1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based provided or approved by manufacturer for applications indicated and capable of taper to feather edge.
2. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

3. Floor Polish: Provide stripper, sealer and polish recommended by the University Environmental Health and Safety (EHS) through the University Project Manager.

PART 3 - EXECUTION

3.1 CLEANING AND PROTECTION

A. Floor Polish: Strip factory seal and apply finish recommended by the University EHS through the University Project Manager.

END OF SECTION 09 65 00
SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Review shop drawings for pattern match, if any, for matching during installation and possible waste factors in ordering required amounts. Provide copy of approved shop drawings on job site during installation.

B. Verification Samples: Submit two full size samples illustrating color and pattern for each carpet material specified.

C. Manufacturer’s Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications
   1. Upon request, provide a representative to assist in project start-up and to inspect installation while in process and upon completion.
      a. Representative will notify designated contact if any installation instructions are not followed.
      b. Representative will be present at 6 month and 11 month punch walks.
   2. 5-year documented experience in manufacturing of carpet tile.

B. Installer Qualifications
   1. Flooring contractor must be certified by the carpet manufacturer prior to bid.
   2. Flooring contractor to be a specialty contractor normally engaged in this type of work and has prior experience in the installation of carpet tiles.
   3. Flooring contractor will be responsible for proper product installation, including floor testing and preparation, as specified by the carpet manufacturer and job conditions herein.

C. Single Source Responsibility: Obtain each type of carpet from one source and by a single manufacturer.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in manufacturer’s original packaging listing manufacturer’s name, product name, identification number, and related information.

B. Store in a dry location, between 60 degrees F and 80 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet in boxes.

C. Make stored materials available for inspection by The University’s representative.

D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.4 PROJECT CONDITIONS

A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer’s installation instructions.
B. Comply with 09 00 00 – Finishes, Part 3.1 for preparation of concrete to receive moisture sensitive flooring.

C. Provide all material used in sub-floor preparation and repair as recommended by the carpet manufacturer and chemically and physically compatible with the carpet system being bid.

D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

E. Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

F. Extra Materials: Refer to Section 01 78 46 – Extra Stock Materials.

1.5 WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

B. If the product fails to perform as warranted when properly installed and maintained, repair or replace the affected area at the discretion of the Manufacturer.

C. Chair Pads are not required for carpet warranty coverage.

D. Include carpet product installed on stairs in warranty provided it is properly installed and maintained.

E. Provide warranty for a specifically defined non-prorated period of 15 years to cover the following. “Lifetime” warranties are not acceptable.
   1. Excessive Surface Wear: More than 15% loss of pile fiber weight
   2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
   3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
   4. Delamination
   5. Edge Ravel
   6. Zippering

F. Provide an additional warranty for a minimum non-prorated period of two years and cover against shrinkage, cupping, and doming.

G. Tuft Bind warranty in lieu of edge ravel and zipper is not acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. FIBER
   1. Nylon Fiber: Fiber must be premium branded nylon. Mill extruded nylon will not be accepted
   2. Apply durable stain inhibitor to the fiber during product manufacturing to resist fiber staining and soiling. (Minimum average of three fluorine analyses of a single composite sample per CRI TM-102: 500 ppm.)
   4. Dye Method: Fiber to be minimum 95% solution dyed
2.2 BACKING CHARACTERISTICS
1. Primary Backing: Synthetic Woven or Non-Woven.
2. Pre-Coat (Fusion Coat): Sealant Vinyl
3. Secondary Backing: Vinyl Hardback. 100% reclaimed-content, nylon reinforced vinyl matrix backing is preferred and should be provided if available.
   a. Density (ASTM D-1667): Minimum 65 lbs/cu ft +/- 5%
   b. Fiberglass Reinforced.
   c. 24” x 24” or 60cm

2.3 PERFORMANCE CHARACTERISTICS
A. Test reports for the following performance assurance testing to be submitted upon request. Submitted results shall represent average results for production goods of the referenced style.

B. Requirements listed below must be met by all products.
   1. Flooring Radiant Panel; ASTM E-648 / NFPA 253: Class 1 (CRF: 0.45 watts/sq cm or greater)
   2. Federal Flammability: CPSC FF 1-70: Passes
   4. Electrostatic Propensity: AATCC 134 (Step & Scuff): 3.0 kV or less
   5. Static Coefficient of Friction: ASTM C-1028: Passes ADA Requirements for Accessible Routes (minimum 0.60)
   7. Lightfastness: AATCC 16E: > 4 @ 100 hours
   8. Vetterman Drum: ASTM D-5417: Minimum 3 @ 22,000 cycles
   9. VOC Chamber Testing
      a. ASTM D-5116: Product inclusive of “dry” adhesive system meets criteria established by the State of Washington Indoor Air Quality Specification for Carpet and/or Carpet & Rug Institute’s (CRI) Indoor Air Quality Carpet Testing Program. If “dry” adhesive (2.02D) not available from manufacturer and “wet” adhesive is used to install the product, carpet and adhesive to meet CRI’s Green Label requirements.
   10. Dimensional Stability: Aachen / ISO 2551: Maximum Change +/- 0.149%

2.4 SUBSTITUTES/ALTERNATES
A. Subject to compliance with all requirements, “or equal” must match the selected colors, have similar aesthetic appearance and tuft density, vinyl backing – preferably 100% reclaimed. Substitution sample and submittals to be considered must be submitted for written approval of quality and color in accordance with bidding documents. Sample of proposed substitute must be inclusive of both the face and proposed backing (color-only sample not acceptable).

2.5 ACCESSORIES
A. Adhesives: Product to be installed using manufacturer’s recommended adhesive. Non adhesive methods are preferred and should be provided if available.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Prepare sub-floor to comply with criteria established in Manufacturer’s installation instructions. Use only preparation materials that are acceptable to the Manufacturer.
   1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation. (*i.e. floor wax*)
   2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.
B. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

C. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

D. There will be no exceptions to the provisions stated in the Manufacturer’s installation instructions.

3.2 INSTALLATION, GENERAL

A. Where demountable partitions or other items are indicated for installation on top of finished carpet tile floor, install carpet tile before installation of these items.

B. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

D. Install borders parallel to walls (where applicable).

E. Trim carpet neatly at walls and around interruptions.

F. Completed carpet is to be smooth and free of bubbles, puckers, and other defects.

3.3 TESTING, CLEANING, AND CERTIFICATION

A. Remove excess adhesive and/or seam sealer from floor and wall surfaces without damage.

B. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and disposed of properly.

C. Clean and vacuum carpet surfaces per manufacturer’s instructions.

D. After each area of carpet is installed, protect from soiling and damage by other trades.

END OF SECTION 09 68 13
SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements:
   1. Single-Source Responsibility: Provide primers and undercoats produced by and certified compatible with each other and with topcoat.
   2. Quality: Provide manufacturer’s first line commercial products.
   3. Locally Available: Provide products readily available within the Denver metropolitan area in 1- and 5-gallon containers. Readily available means within 24-hours of placing order.
   4. Dry Film Thickness (DFT): Apply all coatings in strict conformance with manufacturer’s recommendations for minimum DFT.

1.2 SUBMITTALS

A. MSDS: Contractor to provide Material Safety Data Sheets (MSDS) for all coatings to the University Project Manager prior to application.

1.3 QUALITY ASSURANCE

A. MPI Standards: Provide products that comply with Master Painter Institute (MPI) standards indicated and that are listed in its "MPI Approved Products List."

B. All painting must be of journeyman level craftsmanship, paying special attention to preparation, etching, priming and undercoating.

PART 2 - PRODUCTS

2.1 BLOCK FILLERS

A. Block Filler, Acrylic/Latex, Interior/Exterior for Concrete Masonry Unit Substrates: MPI #4

2.2 PRIMERS/SEALERS

A. Primer, Alkali Resistant, Water Based, for Concrete Substrates: MPI #3

B. Primer Sealer, Interior, Institutional Low Odor/No VOC, for Gypsum Board and Plaster Substrates: MPI #149

C. Primer, Latex, for Interior Wood Substrates: MPI #39

D. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.3 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based, for Ferrous-Metal Substrates: MPI #107

B. Primer, Galvanized, Water Based, for Zinc-Coated Metal Substrates: MPI #134
PART 3 - EXECUTION

3.1 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces: The following system is acceptable, high performance coating specified in SECTION 09 96 00 preferred.
   1. Institutional Low-Odor/No VOC Latex System: MPI INT 3.1M
      a. Prime Coat: Primer sealer, interior, institutional low odor/No VOC, MPI #149.
      c. Topcoat: Latex, interior, institutional low odor/No VOC, semi-gloss (Gloss Level 5), MPI #147.

B. Concrete Substrates, Traffic Surfaces: At all concrete traffic surfaces scheduled to receive sealer.
   1. Water-Based Clear Sealer System: MPI INT 3.2G
      a. First Coat: Sealer, water based, for concrete floors, MPI #99.
      b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

C. CMU Substrates: The following system is acceptable, high performance coating specified in SECTION 09 96 00 preferred.
   1. Institutional Low-Odor/No VOC Latex System: MPI INT 4.2E
      c. Topcoat: Latex, interior, institutional low odor/No VOC, semi-gloss (Gloss Level 5), MPI #147.

D. Steel Substrates: At all steel substrates not indicated to receive high-performance coatings specified in SECTION 09 96 00.
   1. Water-Based Dry-Fall System (for overhead work only): MPI INT 5.1C
      a. Prime Coat: Shop primer to be specified in Division 05.
      b. Topcoat: Dry fall, latex, flat, MPI #118.
   2. Institutional Low-Odor/No VOC Latex System: MPI INT 5.1S
c. Topcoat: Latex, interior, institutional low odor/No VOC, semi-gloss (Gloss Level 5), MPI #147.

E. Galvanized-Metal Substrates: At all galvanized metal substrates not indicated to receive high-performance coatings specified in SECTION 09 96 00.
1. Water-Based Dry-Fall System (for overhead work only): MPI INT 5.3H
   a. Prime Coat: Dry fall, water based, for galvanized steel, flat (Gloss Level 1), MPI #133.
   b. Topcoat: Dry fall, water based, for galvanized steel, flat (Gloss Level 1), MPI #133.
2. Institutional Low-odor/No VOC Latex System: MPI INT 5.3N
   a. Prime Coat: Primer, galvanized, water based, MPI #134.
   c. Topcoat: Latex, interior, institutional low odor/No VOC, semi-gloss (Gloss Level 5), MPI #147.

F. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. Institutional Low-odor/No VOC Latex System: MPI INT 5.4G
   a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
   c. Topcoat: Latex, interior, institutional low odor/No VOC, semi-gloss (Gloss Level 5), MPI #147.

G. Wood Substrates:
1. Institutional Low-odor/No VOC Latex System: MPI INT 6.1Q, MPI INT 6.2L, MPI INT 6.3V, and MPI INT 6.4T
   a. Prime Coat: Primer, latex, for interior wood, MPI #39.
   c. Topcoat: Latex, interior, institutional low odor/No VOC, semi-gloss (Gloss Level 5), MPI #147.

H. Gypsum Board and Plaster Substrates:
1. Latex System: MPI INT 9.2A. At gypsum board, GFRG, and plaster substrates scheduled to receive gloss paint.
   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   c. Topcoat: Latex, interior; gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.
2. Institutional Low-odor/No VOC Latex System: MPI INT 9.2M. At all gypsum board, GFRG, and plaster substrates, unless indicated otherwise.
   a. Prime Coat: Primer sealer, interior, institutional low odor/No VOC, MPI #149.
   c. Topcoat: Latex, interior, institutional low odor/No VOC; Provide one of the following as indicated in Finish Schedule:
      1) Flat (Gloss Level 1), MPI #143
      2) Egg-shell (Gloss Level 2), MPI #144 or (Gloss Level 3), MPI #145
      3) Semi-gloss (Gloss Level 5), MPI #147
   d. Typical Sheen: Egg-shell (Gloss Level 2 or 3) unless indicated otherwise.

END OF SECTION 09 91 23
SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

A. Design Requirements
1. Comply with Part 1.6, B for room and door numbering and Part 1.6, C for elevator numbering.
2. Include all interior signs within the construction contract.
3. Update existing signage to meet current standards for renovation projects.
   a. The signage system may be customized with input from the Facility Operations, the building administrator through the University Project Manager.
   b. Exemption: Lawrence Street Center and CU Denver Building. Match signage to existing building signage.

1.2 DEFINITIONS

A. Way Finding Signs:
1. Type A1 – Directional by Department: Place one wall mounted sign at each corridor junction and main entry points in each building. Two signs may used as required. Indicate which direction to go for each department, conference room, etc. Location to be most readily visible to the preponderance of the traffic flow at the intersection. The size of the sign can vary depending on the quantity of department names desired.
2. Type A2 – Directional by Room Number: Place one overhead sign at each corridor junction where a wall is not available to accept a Type A1 sign. Indicate room number ranges in lieu of departments.
3. Type B1 - Room Identification (Room Number with Paper Insert):
   a. At each active corridor entrance to a room, install a sign with the room number. Not used for mechanical, electrical, janitorial, telecom, restrooms, or most storage rooms.
   b. Paper insert (Sign Type H) content may vary and can include the following information: Administrative unit name, the name(s) if each individual(s) working in the room, and individual’s title (this will be the department’s option). Coordinate with the University Project Manager.
   c. Top of sign to be 60” from the finished floor surface on the latch side of the door, with the sign edge one inch from the door frame. Where architectural constraints preclude this location, the Building Administrator will determine an alternate location through the University Project Manager.
4. Type B2 – Suite Identification (Room Number with Paper Insert):
   a. At each active corridor entrance to a suite, install a sign with the range of room numbers. Not used for mechanical, electrical, janitorial, telecom, restrooms, or most storage rooms.
   b. Paper insert (Sign Type H) content may vary and can include the following information: Administrative unit name, the name(s) if each individual(s) working in the room, and individual’s title (this will be the department’s option). Coordinate with the University Project Manager.
   c. Top of sign to be 60” from the finished floor surface on the latch side of the door, with the sign edge one inch from the door frame. Where architectural constraints preclude this location, the Building Administrator will determine an alternate location through the University Project Manager.
5. Type B3 – Room Identification (no number): Typically used for additional suite or room information. Mount directly below sign type B1 or B2.
6. Type B4 – Identification Frame: Typically used to hold unique sign plaques.
7. Type C - Room Number: Where Room Identification Signs (Type B1 or B2) are not installed, provide a room number sign at each doorway from a corridor into a room, and each doorway from
one room into an adjoining room. These signs are used for mechanical, electrical, janitorial, telecom, restrooms, and most storage rooms.

a. Provide room number signs on the corridor side of the door frame.
b. Mount on the head of the door frame, centered above the door.
c. Mount at door header height when used to identify lab alcoves and bays.

8. Type D - Restroom Identification: Used in addition to sign type C. Provide at the corridor side to designate use as men, women, unisex or shower. Sign information will show ADA accessibility as applicable.

a. Top of sign to be 60” from the finished floor surface on the latch side of the door, with the sign edge one inch from the door frame. Where architectural constraints preclude this location, the Building Administrator will determine an alternate location through the University Project Manager.

9. Type E - Unique Door Identification: Where a door number is not the same as a room number (i.e. more than one door into a room) or where doors separate portions of corridors and are not associated with a room number, install signs identifying the “unique” door number.

a. Mount right justified on the corridor side of the door header.
b. Mount right justified on the both sides of the door header at doors separating portions of corridors or between two rooms.

10. Type F - Exterior Door Identification: At the exterior face of all exterior doors, mount exterior door identification signs on the head of the door frame, centered above the door to identify the designated door number.

11. Type G - Elevator Identification: Mount centered on elevator door frame head at each elevator. Include the University building number and elevator cab number.

12. Type H – Paper Insert: For use with Type B1, B2, and B4. Coordinate information to be printed on paper insert with the University Project Manager.

B. Safety/Code Signs:

1. Type L - Room Capacity: Locate at the main exit from the room.
2. Type M1 - Outside the Stair/Stairwell: Mount adjacent to door leading into the stairwell.
3. Type M2 – Outside the Transitional Stair/Stairwell: Mount adjacent to door leading into the stairwell.
4. Type N - Inside the Stair/Stairwell: Mount adjacent to door leading out of the stairwell.
5. Type P – Caution: Provide at entry to lab suites, lab alcoves, procedure rooms, dark rooms and environmental rooms. For use with Type B4. Mount below Type B signs, where applicable.
6. Type Q – Emergency Quick Reference Guide: Mount in every public space or room, classrooms, laboratories, meeting spaces, and near red phones. Can be used to display non-emergency information.

C. Notices and Displays: Coordinate locations with the University Project Manager.

1. Type S – Elevator Notice and Display Panels: Mount inside the elevator cab.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: ASI Sign Systems; ASI Interior 20 Series.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. ASI Sign Systems, Inc; 303-755-0997
2. Forum Engraving; 303-761-8084
3. Art Form Signs; 303-975-4641

2.2 SIGNAGE MATERIALS/COMPONENTS

A. Product
1. Ceiling Mounted, Projected, and Wall Mounted Signs:
   a. Text or Graphic Technique: Screen process
2. Interior “Paperflex” “Inhouse” Updatable Signs
3. Vinyl Die Cut Characters

B. Materials and Components
1. Fixture Aluminum Panels: Extruded aluminum, alloy AA6060, with high temperature cured polyester color coating. Provide one piece formed aluminum/photopolymer panel for ADA-Ready sizes of 3-1/4” (82.5mm) high and above.
2. Face Components:
   a. ADA-Ready Panels: Aluminum-based ASI Intouch photopolymer tactile and Braille characters with high temperature cured polyester color coating.
   b. Graphic Panels: High-strength, cold-rolled, 1/32” (0.75 mm) aluminum alloy with high temperature cured polyester coating.
3. End Clips:
   a. ASI 6” and 8” ADA-Ready Panels Extruded aluminum, alloy AA6060, with high temperature cured polyester color coating or similar.
   b. ASI Panels: Injection molded plastic or similar
4. Mounting Hardware:
   a. Wall Rails: Extruded aluminum, alloy AA6060, track-type rail mounted to wall with manufacturer recommended mechanical fasteners or similar.
   b. Adhesive: 3M VHB Adhesive Transfer Tape.

C. Finishes:
1. Colors:
   a. Type B Room Identification Signs:
      1) Main Background Color: SC-903 Medium Grey
      2) Room number and dash: SC-906 Cool Grey
      3) Rule line: SC-906 Cool Grey
      4) Paper Insert: White
   b. All Other Signs:
      1) Main Background Color: SC-903 Medium Grey
      2) Font: SC-922 Bone
      3) Rule line: SC-906 Cool Grey (where applicable)
2. Surface Treatment Finish: Manufacturer’s standard two-phase finishing process.
   a. Phase One: Chromatized priming with 2μ depth chrome layer for optimum surface coat adhesion and weatherability.
   b. Phase Two: Painting process employing two component, water-based, non-toxic, lead-free, zero emissions, high temperature cured polyester coating of 20-30μ deep.

D. Way Finding Signs: (Refer to Part 4 – Illustrations for graphical representation and sizes.)
1. Type A1 – Directional by Department:
   a. Header Panel: Provide 1-1/2” Helvetica Regular font for floor level number, and 3/4” Helvetica Regular font for building name.
   c. Mount: Wall Rails with Adhesive.
2. Type A2 - Directional by Room Number:
   a. Double Faced or Single Faced
   b. Text: 3” Helvetica Regular, #, Condensed 80% font. Provide uppercase letters only.
   c. Mount: Ceiling Mounted.
3. Type B1 Room Identification (Room Number with Paper Insert):
   a. Header Panel: Provide raised text, 5/8” Helvetica Regular font with 24 pt, grade II Braille 3/8” below copy. Provide uppercase letters at all letters within the room number text except the last character, where applicable.
b. Paper insert content, font, and character size may vary per building. Coordinate with the University Project Manager. Provide paper for insert and computer program with all fonts to the University.

c. Mount: Wall Rails with Adhesive.

4. Type B2 – Suite Identification (Room Number with Paper Insert):
   b. Paper insert content, font, and character size may vary per building. Coordinate with the University Project Manager. Provide paper for insert and computer program with all fonts to the University.
   c. Mount: Wall Rails with Adhesive.

5. Type B3 – Room Identification (no number):
   a. Provide 5/8” Helvetica Regular font. Coordinate text with the University Project Manager.
   b. Option: Silk Screen Symbol. Coordinate with the University Project Manager.

6. Type B4 – Identification Frame:

7. Type C – Room Number:
   a. Provide 5/8” Helvetica Regular font. Provide uppercase letters at all letters within the room number text except the last character, where applicable.
   b. Provide second surface silk-screened copy on 1/8” phenolic.
   c. Mount: Adhesive

8. Type D Restroom Identification:
   b. Mount: Wall Rails with Adhesive.

9. Type E – Unique Door Identification:
   a. Provide 5/8” Helvetica Regular font. Provide uppercase letters at all letters within the door number text except the last character, where applicable.
   b. Vinyl die-cut alpha numeric characters.
   c. Provide appropriate contrast with door frame color to meet all applicable code requirements.

10. Type F – Exterior Door Identification:
    a. Provide Door Number information in 5/8” Helvetica Regular. Provide uppercase letters only.
    b. Provide second surface silk-screened copy on 1/8” phenolic.
    c. Mount: Adhesive

11. Type G – Elevator Identification:
    a. Provide 5/8” Helvetica Regular. Provide uppercase letters only.
    b. Vinyl die-cut alpha numeric characters.

12. Type H – Paper Insert:
    a. Paper insert content, font, and character size may vary per building. Coordinate with the University Project Manager.
    b. Provide paper for insert and computer program with all fonts to the University.

E. Safety/Code Signs: (Refer to Part 4 – Illustrations for graphical representation and sizes.)

1. Type L - Room Capacity:
   a. Provide 3/8” Helvetica Regular for text; 1/2” Helvetica Regular for numerical characters. Provide uppercase letters only.
   b. Mount: Adhesive

2. Type M1 - Outside the Stairwell:
   b. Main Panel: Provide silk screened stair symbol.
   c. Mount: Wall Rails with Adhesive.

3. Type M2 – Outside the Transitional Stair/Stairwell:
b. Main Panel: Provide 1/2" Helvetica Regular. Provide uppercase letters only. Provide silk screened stair symbol.
c. Mount: Wall Rails with Adhesive.

4. Type N – Inside the Stairwell:
   a. Provide Helvetica Regular font with 24 pt, grade II Braille 3/8” below copy. Provide uppercase letters only.
   b. Comply with UFC text size requirements
   c. Mount: Adhesive

5. Type P – Caution:
   a. Coordinate with Environmental Health and Safety (EHS) through the University Project Manager.

6. Type Q – Emergency Quick Reference Guide:
   a. Basis of Design: Deflect-O Classic Image Wall Mount Sign Holder, Clear, 8-1/2”x11” Portrait

F. Notices and Displays
   1. Type S – Elevator Notice and Display Panels
      a. Provide window sign with 1/8” Clear Acrylic Panels.
      b. Provide 1/4” stainless steel accent strips at header and footer panels. Refer to Part 4 - Illustration.
      c. Provide Gyford Aluminum 3/16” barrel with cap; Brushed finish. Adhere caps.
      d. Mount: Anchors set in wall surface.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Mounting
   1. Mount all signs in accordance with ICC/ANSI 117.1-2003 and ADAAG requirements.
PART 4 - ILLUSTRATIONS

4.1 Type A1 – Directional by Department

Typical A1 Sign

Shorter A1 Sign Option
4.2 Type A2 – Directional by Room Number

4.3 Type B1 – Room Identification (Room Number with Paper Insert)

4.4 Type B2 – Suite Identification (Room Number with Paper Insert)
4.5 Type B3 – Room Identification (no number)

4.6 Type B4 – Identification Frame

4.7 Type C – Room Number
4.8 Type D - Restroom Identification

4.9 Type E - Unique Door Identification

4.10 Type F - Exterior Door Identification

4.11 Type G - Elevator Identification
4.12 Type H – Paper Insert: No Illustration Provided.

4.13 Type L: Room Capacity

4.14 Type M1: Outside the Stair/Stairwell
4.15  Type M2: Outside the Transitional Stair/Stairwell

4.16  Type N: Inside the Stair/Stairwell
4.17 Type P: Caution

4.18 Type Q – Emergency Quick Reference Guide
4.19 Type S: Elevator Notice and Display Panels

END OF SECTION 10 14 00
SECTION 21 00 10
FI RE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Refer to specification section 23 0010 "Mechanical General Provisions" for this division.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
   
   A. Pipe, fittings, valves, and connections for sprinkler and standpipe systems.

1.2 RELATED REQUIREMENTS
   
   A. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
   
   B. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS
   
   A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.
   
   
   C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
   
   D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
   
   E. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 2003 (ANSI/ASME B16.5).
   
   
   G. ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded; The American Society of Mechanical Engineers; 2005.
   
   
   I. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
   
   
   K. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers; 2004.
Auraria Higher Education Center  
Tivoli Fit 2 More Classrooms


S. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.


X. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

Y. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

1.4 SUBMITTALS


1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labelling in place.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A 53 Schedule 40, black.
   4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   5. Saddle tee style connections will not be acceptable.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and foreign material, from inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
D. Install piping to conserve building space, to not interfere with use of space and other work.
E. Group piping whenever practical at common elevations.
F. Sleeve pipes passing through partitions, walls, and floors.
G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
H. Pipe Hangers and Supports:
1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

N. Provide drain valves at main shut-off valves, low points of piping and apparatus.

### 3.3 ADJUSTING AND CLEANING

A. Sprinkler Piping Flushing
   1. Prior to connecting sprinkler risers for flushing, flush water feed mains, lead in connections and control portions of sprinkler piping.
   2. After fire sprinkler piping installation is completed and before piping is placed in service, flush entire sprinkler system to remove foreign substances, under pressure as specified by NFPA No. 13.
   3. Continue flushing until water is clear, and verify that debris has not clogged sprinklers.

### 3.4 FIELD QUALITY CONTROL

A. Hydrostatic Testing
   1. After flushing system, test fire sprinkler piping hydrostatically for a period of 2 hours at minimum 200 psi; or at 50 psi in excess of maximum static pressure when maximum static pressure in excess of 150 psi.
   2. Inspect system for leakage at joints.
   3. Measure hydrostatic pressure at low point of each system or zone being tested.

B. Repair or replace piping system to eliminate leakage in accordance with NFPA standards for “little or no leakage”, and retest as specified to demonstrate compliance.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

1.2 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

B. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

1.3 REFERENCE STANDARDS


1.4 SUBMITTALS

A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Shop Drawings:
   1. Submit shop drawings of entire fire protection system after review/approval by inspection agency and the Owner's Insuring Agent.
   2. Include complete system drawn to scale (1/8 inch = 1'-0") with all parts, sprinkler piping, risers, mains, branches, valves and hangers fully coordinated with all construction such as beams, joists, columns, ducts, fans, light fixtures, special electrical equipment and systems, heating, air conditioning, and plumbing piping.
   3. All interferences avoided, and sprinkler installation varied as approved by Architect/Engineer.
   4. Hydraulic calculations and sizes.
   5. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

C. Delegated-Design Submittal: For Sprinkler Systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
D. Manufacturer’s Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Maintenance Materials: Furnish the following for MUHC’s use in maintenance of project.
1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Conform to UL requirements.

B. Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the state of Colorado.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.


C. Malleable- or Ductile-Iron Unions: UL 860.

D. Cast-Iron Flanges: ASME 16.1, Class 125.

E. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.


G. Grooved-Joint, Steel-Pipe Appurtenances:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil International, Inc.
   b. Corcoran Piping System Co.
   c. National Fittings, Inc.
   d. Shurjoint Piping Products.
   e. Tyco Fire & Building Products LP.
   f. Victaulic Company.
2. Pressure Rating: 250 psig minimum.

H. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
   1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
   2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:

2.4 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Light hazard; comply with NFPA 13. Building also contains Ordinary Hazard Group 1 and Group 2 areas; comply with NFPA 13.
   1. Ordinary Hazard spaces include soiled and clean utility areas, linen and equipment spaces.
   2. All other areas are considered light hazard.

C. Water Supply: Contractor shall be responsible for requesting or performing a flow test of the water supply system in coordination with the water district and the local fire department. Obtain the following data for use in the hydraulic design of the fire suppression sprinkler system:
   1. Static pressure
   2. Residual pressure
   3. Flow

2.5 SPRINKLERS

A. Suspended Ceiling Type: Concealed quick response, pendant type with flat cover plate.
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
   4. Coverage: Extended

B. Exposed Area Type: Quick response upright type.
   1. Finish: Brass in unfinished areas. White in finished areas.
   2. Fusible link: Glass bulb type temperature rated for specific area hazard.
   3. Coverage: Extended

C. Sidewall Type: Quick response horizontal sidewall type.
1. Finish: Brass in unfinished areas. White in finished areas.
2. Escutcheon Plate Finish: To match sprinkler finish.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Sprinkler heads installed where they may be exposed or subjected to mechanical damage shall be furnished complete with head guards.
1. Finish: To match sprinkler finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Place pipe runs to minimize obstruction to other work.

D. Place piping in concealed spaces above finished ceilings.

E. Center sprinklers in suspended ceilings in narrow dimension and at quarter points of long dimension of acoustic panels.

F. Sprinkler heads are to be covered by the contractor at the time of installation with plastic bags or covers secured by taping or rubber bands for protection against painting. Sprinkler head covers shall be removed after the completion of field painting. Replace painted sprinklers.

G. Flush entire piping system of foreign matter.

H. Hydrostatically test entire system.

I. Require test be witnessed by authority having jurisdiction.

3.3 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
   1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Standard-weight, black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
   1. Standard-weight, black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   2. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

D. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION
SECTION 23 00 10
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Special Conditions and Contract Documents are part of these specifications. Consult them further instructions and be governed by the requirements thereunder.

1.2 DESCRIPTION

A. Work Included

1. Furnish all labor and materials and perform all operations necessary for the installation of complete and operating mechanical systems subject to the conditions of the contract. The work also includes the completion of such mechanical and electrical details not mentioned or shown which are necessary for the successful operation of all systems; this includes the furnishing of all materials for filling systems to make them operable, including water, refrigerant, oil, grease, antifreeze and brine. Prove satisfactory operation of all equipment and controls to the MECHANICAL ENGINEER on request.

B. Work Not Included

1. Certain labor and materials may be furnished and/or installed under other divisions of these specifications. Coordinate with other trades and arrange the work to make the parts fit together. The following items are to be accomplished under other divisions of these specifications.

   a. Temporary Heat: See "Temporary Heat" Paragraph in Part 1 of this Specification Section and Division 01.
   b. Concrete: See "Concrete" Paragraph in Part 3 of this Specification Section.
   c. Electrical Equipment and Wiring: See "Electrical Equipment and Wiring for Mechanical Division" Paragraph in Part 3 of this Specification Section.

C. Equipment Furnished by Owner

1. The Owner will award contracts, which will commence concurrently with this contract. Specifically this work will include:

   a. Equipment Installation: Refer to appropriate drawings for equipment furnished by the Owner.

2. Rough-in service pipes to locations as required by architectural and mechanical drawings and equipment shop drawings. Provide service valves on all pipes except waste and vent pipes, plug or cap these. Final connections to equipment shall be made by Contractor.
1.3 PROVISIONS

A. Work performed under this division of the specifications shall conform to the requirements of Division 1, and the mechanical drawings and all items hereinafter specified.

1. Prior to any work being performed under this division, examine architectural, and electrical specifications. If any discrepancies occur between them and the mechanical drawings and specifications, report discrepancies to the Architect in writing and obtain written instructions for the work.

2. Mechanical drawings are diagrammatic, but shall be followed as closely as actual construction of the building will permit. All changes from drawings necessary to make the mechanical work conform to the building as constructed shall be made without additional cost to the Owner.

3. Coordinate the mechanical work with the General Contractor and be responsible to him for satisfactory progress of the work. Coordinate mechanical work with all other trades on the project without additional cost to the Owner.

4. All work and materials covered by drawings and specifications shall be subject to review at any time by representatives of the Architect and Owner. If the Architect or Owner’s agent finds any materials or installation that does not conform to these drawings and specifications, Contractor shall remove the material from the premises and correct the installation to the satisfaction of the agent.

5. In acceptance or rejection of installed mechanical systems, no allowance will be made for lack of skill on the part of the installers.

1.4 EXAMINATION OF PREMISES/SITE

A. Visit the premises site before submitting bid as no extras will be allowed for lack of knowledge of existing conditions.

1.5 CODES AND STANDARDS

A. Conform to applicable sections of NFPA 13 and 24.


C. Conform to all applicable State and Local Codes.

D. In case of difference between these specifications, codes, laws, industry standards, and/or utility company regulations the most stringent shall govern.

E. Americans with Disabilities Acts (ADA) and American National Standards Institute (ANSI) 117.


G. Joint Commission for Accreditation of Healthcare Organizations (JCAHO).
1.6 PERMITS, FEES AND NOTICES

A. Apply for and pay for all permits, fees, licenses and inspections for this Division of work.

B. Notify proper authorities when work is ready for inspections required by applicable codes, rules and regulations, allowing sufficient time for inspections to be made without hindering progress of the work. Furnish to the Owner copies of inspection certificates of acceptance.

1.7 EXISTING CONDITIONS

A. Existing systems and conditions shown on drawings for existing buildings are to be noted “for guidance only”. The Mechanical Contractor shall field check all existing conditions prior to bidding and is to include in his bid an allowance for removal and/or relocation of existing ductwork, piping, fixtures, or other equipment and adapt new and existing mechanical system to all other work as required.

B. Existing ductwork, equipment, piping, etc. which are not indicated for reuse become the property of the Contractor. However, fixtures, pumps, fans, fire protection equipment, etc. shall become the property of the Owner unless noted otherwise.

C. System outages shall be permitted only at times approved by Owner-in writing. Work which could result in an accidental outage shall be performed with the Owner’s maintenance personnel advised of such work.

D. Service shall be maintained to existing areas during construction.

1.8 DRAWINGS

A. Mechanical drawings are diagrammatic and are not to be scaled for dimensions. Take all dimensions from Architectural drawings, certified equipment drawings, and from the structure itself before fabricating any work. Verify all space requirements, coordinating with other trades, and install the systems in the space provided without extra charges to the Owner.

B. Conceal all piping in finished areas of the building except where otherwise noted on the drawings.

C. Install all equipment in accordance with manufacturer's recommendations, unless approval is given in writing by the MECHANICAL ENGINEER for deviation.

1.9 EXAMINATION OF BIDDING DOCUMENTS

A. Each bidder shall examine the bidding documents carefully, and not later than seven days prior to the date of receipt of bids, shall make written request to the Architect for interpretation or correction of any discrepancies, ambiguity, inconsistency, or error therein which he may discover. Any interpretation or correction will be issued as an addendum by the Architect. Only a written interpretation or correction by addendum shall be binding. No bidder shall rely upon interpretations or corrections given by any other method. If discrepancies, ambiguity, inconsistency, or error are not covered by addendum or written directive, Contractor shall...
include in his bid, labor materials and methods of construction resulting in higher cost. After award of contract, no allowance or extra compensation will be made on behalf of the Contractor due to his failure to make the written requests as described above.

B. The person submitting the request will be responsible for its prompt delivery. Failure to so request clarification of any inadequacy, omission, or conflict will not relieve the Contractor of responsibility. The signing of the Contract will be considered as implicitly denoting that the Contractor has a thorough comprehension of full intent and scope of the working drawings and specifications.

1.10 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment.

B. Refer to equipment specifications in other Divisions for additional rough-in requirements.

1.11 ACCESS DOORS

A. Furnish access doors of type suitable to Architect and provide to General Contractor to construct into the building. Access doors should be provided in all locations where access is required.

B. Provide painted, steel (unless noted otherwise) access doors with key lock suitable for the surface in which they are installed and satisfactory to the Architect.

1. Plaster finish walls and ceilings: Recessed style.
3. Drywall walls and ceilings: Flush panel.
4. Remodel Applications: Flanged flush panel.
5. Corrosive environments, including but not limited to, restrooms, locker rooms, pool equipment rooms, and natatoriums: Panel and frame shall be aluminum or stainless steel. All associated hardware and fasteners shall be stainless steel.
6. Panels in fire and/or smoke rated assemblies shall be listed for the application and carry the appropriate rating for the assembly in which they are installed.

1.12 COORDINATION DRAWINGS

A. Prepare and submit a set of coordination drawings showing major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of \( \frac{1}{4}''=1''-0'' \) or larger. Indicate the locations of all equipment and materials, including clearances for servicing and maintaining equipment. Indicate movement and positioning of large equipment into the building during construction.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessary limited) to the following:

1. Ductwork
2. Hydronic Piping
3. Plumbing Piping
4. Fire sprinkler piping
5. Electrical conduit mains

1.13 MECHANICAL INSTALLATIONS
A. Coordinate mechanical equipment and materials installation with other building components.
B. Verify all dimensions by field measurements.
C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
E. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
F. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible, and in accordance with minimum required clearances as specified in codes and regulations.
G. The word “concealed” as used in this specification refers to such spaces as pipe and duct chases, pipe and duct trenches, above plastered ceilings, in walls and buried where pipe and/or duct is inaccessible when building is complete. “Exposed” is intended to be within equipment rooms, unfinished areas, above “push up” ceilings, accessible pipe and duct tunnels.
H. The term “furnish” means supply and deliver to Project, unless otherwise defined in greater detail. The term “install” is used to describe operations at Project, from inspecting and unloading, to completion in place, ready for intended use. The term “provide” means furnish and install, complete and ready for intended use, unless otherwise defined in greater detail.

1.14 SUBMITTALS
A. Submit under provisions of Division 1.
B. Proposed Product List: Include Products specified in Divisions 21, 22 and 23 specifications.
C. Submit shop drawings and product data grouped to include complete submittals of related systems, Products, and accessories in a single submittal.
D. Mark dimensions and values in units to match those specified.
E. Submit miscellaneous items specified on the drawings, but not covered in the specifications. Make no substitutions without prior approval from the Architect.
1.15  SHOP DRAWINGS

A. Submit shop drawings on all equipment, Temperature Controls and Fire Protection. Provide shop drawings to the Architect and Engineer showing locations of all access panels.

B. Shop drawings required for this project are as follows:

   1. Plumbing fixtures
   2. Insulation
   3. Fire Protection
   4. Piping, Valves and appurtenances.
   5. Temperature controls
   6. VAV terminals

C. Present shop drawing submittal data at one time, indexed in a neat and orderly manner. Partial submittals will not be accepted. Provide five sets of submittal data, unless noted otherwise in Division 1. Do not begin work until one (1) copy is returned.

D. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet construction schedule, together with any special handling charges, shall be borne by the Contractor.

E. Contractor agrees that shop drawing submittals processed by the engineer are not change orders. The purpose of shop drawing submittals by the Contractor is to demonstrate to the engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. Contractor further agrees that if deviations, discrepancies, or conflicts between shop drawing submittals and contract documents in the form of design drawings and specifications are discovered either prior to or after shop drawings and specifications shall control and shall be followed.

F. Contractor to provide manufacturers’ recommended installation manuals for equipment.

G. Review of shop drawings does not relieve this Contractor from the responsibility of furnishing equipment and materials of proper dimension, size, quantity, quality and all performance characteristics to efficiently perform the requirements and intent of the contract documents. Review does not relieve this Contractor from responsibility for errors on the shop drawings. If the shop drawings deviate from the contract documents, advise the MECHANICAL ENGINEER of the deviations in writing accompanying the shop drawings, including the reasons for the deviations. Coordinate all required changes with the other trades affected. If the changes are occasioned by the Contractor, he shall pay any costs involved.

1.16  PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.
1.17 PROJECT RECORD DRAWINGS

A. During the process of the work, maintain an accurate record of the installation of the mechanical systems. Upon completion of the mechanical systems installation, transfer all record data to blue-line prints of the original drawings. Drawings shall include all addendum items, charge orders, alternations, reroutings, etc. As a condition of acceptance of the project, deliver to the Architect one copy of the record drawings.

1.18 WARRANTY

A. All materials and equipment shall be new unless otherwise specified.

B. Guarantee all workmanship, materials and equipment and replace any found defective without cost to the Owner, for one year after final acceptance, as defined in General Conditions.

C. Each warranty for longer than the one year described above (that comes with equipment used on the job) shall be passed on to the owner with dates of start and end of the warranty.

1.19 ENGINEERING BY CONTRACTOR

A. The construction of this building requires the contractor to design several systems or subsystems. All such design shall be the completed responsibility of the contractor.

B. Systems or subsystems which require engineering responsibility by the contractor include, but are not limited to:

1. Fire sprinkler.
2. Equipment supports, not fully detailed in the drawings.
3. Pipe hangers and anchors not specified in these documents, or catalogued by the manufacturer.
4. Temperature controls.

PART 2 - PRODUCTS

2.1 EQUIPMENT MANUFACTURER

A. Equipment in the following categories shall be of one manufacturer or available through one manufacturer for each category to facilitate ease of maintenance for the Owner.

1. Temperature Controls shall be by Johnson Controls, Inc.
2. Plumbing Fixture Trim
3. Thermometers
4. Pressure Gauges
5. Butterfly Valves
6. Plug Valves
7. Globe Valves
8. Check Valves
2.2 SUBSTITUTIONS (PRIOR APPROVALS)

A. Bidder's Choice

1. Materials, equipment or services listed by several identifying names are intended to be bidder's choice, and any of the listed names may be bid without soliciting prior acceptance. Where more than one name is given in the specifications, the first named manufacturer's material, equipment or services is contemplated and any changes and their costs, required to accommodate the other named material or equipment as well as space requirements for the other named materials or equipment, must be assumed by the Contractor in his bid. (See Shop Drawing Requirement).

B. Performance Specification

1. When any product is specified only by requirement to meet an industry standard or regulating body standard (such as U.L., AGA, AWWA, ANSI, etc.) and the item proposed carries approval of that body, no prior acceptance by the MECHANICAL ENGINEER is needed.
2. When any product or service is specified by requirement to meet a performance standard or is specified by a generic specification, (no manufacturers name listed) no prior acceptance by the MECHANICAL ENGINEER is needed except as specifically called for in these specifications.

C. Acceptance

1. Material and equipment specified is used as a basis of standard, and while not specifically mentioned, material gauges, weights, appearance and space requirements must be met by any substitutions.
2. Action for substitutions specified herein will be given only after the receipt of complete data showing performance over entire range, physical dimensions and material construction all SPECIFICALLY marked for the individual item. Letter of transmittal with at least one (1) copy and one (1) marked up copy of all descriptive data shall be submitted to the MECHANICAL ENGINEER'S Office.
3. Submit shop drawings for all materials and equipment other than the first named in these specifications showing any changes required in piping, ducting, electrical wiring, space allocation etc. Be responsible to make all changes required to accommodate and to pay for these changes. Coordinate changes required with all other trades. Pay for all changes resulting from re-arranging equipment.
4. See General Conditions for method of notification of acceptance.

2.3 SAFETY PROVISIONS

A. Any refrigeration system containing CFC-11, CFC-12, HCFC-123, HCFC-22, or any of the other refrigerants listed in the Clean Air Act as a Class I or Class II Ozone Depleting Compound shall comply with the Clean Air Acts.
B. As a minimum all systems shall be equipped with refrigerant recovery service valves, relief valves capable of resetting after activation, and for system with more than 50 pounds of charge, and isolateable receiver and/or condenser capable of holding the complete charge.

PART 3 - EXECUTION

3.1 STORAGE

A. Provide for proper storage of all materials and equipment and assume responsibility for losses due to any cause. All storage shall be within the contact limit lines of the building site. Cover and store all equipment and materials out of elements; any rusted or weather damaged item shall not be used.

3.2 PRODUCT INSTALLATION

A. Manufacturer’s Instructions

1. Except where more stringent requirements are indicated, comply with the product manufacturer’s instructions and recommendations.
2. Consult with manufacturer’s technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
3. If a conflict exists, notify the Architect/Engineer in writing and obtain his instruction before proceeding with the work in question.

B. Movement of Equipment

1. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed.
2. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of equipment.

C. Heavy Equipment

1. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.
2. Where mechanical products to be installed on the existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.

D. Clearances

1. Install piping and ductwork:
   a. Straight and true.
   b. Aligned with other work.
   c. Close to walls and overhead structure (allowing for insulation).
   d. Concealed, where possible, in occupied spaces.
   e. Out-of-the-way with maximum passageway and headroom remaining in each space.
Auraria Higher Education Center  
Tivoli Fit 2 More Classrooms

2. Except as otherwise indicated, arrange mechanical services and overhead equipment with a minimum of:
   a. 7’0” headroom in storage spaces.
   b. 8’6” headroom in other spaces.

3. Do not obstruct windows, doors or other openings.
4. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).
5. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping pipes whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, etc., as required to affect these offsets, transitions and changes in direction.

E. Access
   1. Install all work to permit removal (without damage to other parts) of coils, heat exchanger bundles, boiler tubes, fan shafts and wheels, filters, belt guards, sheaves and drives, and all other parts which might require periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit ready access to valves, traps, starters, motors, control components and to clear the openings of doors and of access panels. Furnish access panels for all mechanical equipment and valves requiring access in concealed locations for installation by contractor.

3.3 PROTECTION OF WORK AND PROPERTY

A. Where there are existing facilities, be responsible for the protection thereof, whether or not such facility is to be removed or relocated. Moving or removing any facility must be done so as not to cause interruption of the work of Owner’s operation.

B. Close all pipe and duct openings with caps or plugs during installation. Cover all fixtures and equipment and protect against injury. At the final completion, clean all work and deliver in an unblemished condition, or refinish and repaint at the discretion of the Architect.

C. Do not allow any fans in the HVAC system to operate before the area served by the fan has been cleaned and vacuumed of all debris and dust which might enter the system.

D. Any equipment, duct or piping systems found to have been damaged or contaminated above “MILL” or “SHOP” conditions shall be replaced or cleaned to the Engineer’s satisfaction.

E. Initial fill of traps
   1. Provide initial water seal fill for all waste p-traps, condensate traps, or similar traps.

3.4 PROTECTION OF POTABLE WATER SYSTEMS

A. All temporary water connections shall be made with an approved back flow preventer.

B. All hose bibbs shall have, as a minimum, a vacuum breaker to prevent back flow.
C. Direct connections to hydronic systems shall only be made through a reduced pressure back flow preventer.

3.5 PROTECTION OF SYSTEMS SERVING OCCUPIED SPACES

A. Where work is being performed in occupied spaces, or occupancy is to be phased in with ongoing construction contractor shall prevent contamination of all systems serving the occupants including but not limited to:

1. Supply or return air
   a. Systems shall be capped or provided with adequate particulate and gas phase filtration to prevent dust, chemical, or biological contamination. Particulate filters shall be as a minimum equivalent to those specified for the completed system.

2. Domestic Water
   a. Isolate sterilized portions from non-sterilized portions.

3.6 REFRIGERATION SYSTEMS

A. All technicians involved in the installation of refrigeration systems shall be certified and trained in accordance with the applicable sections of the Clean Air Act.

B. No refrigerant shall be intentionally vented to the atmosphere. All refrigerant shall be recovered before opening a closed system for charging, evacuation, service, installation, or demolition.

3.7 ASBESTOS

A. The identification and/or abatement of asbestos hazards is not part of this contract.

1. If asbestos is encountered, contact Owner for instructions.

3.8 DEMONSTRATION

A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings and Operation and maintenance Manual submittal and systems demonstration.

1. Demonstrate that each system operates properly.
2. Explain the operation of each system to the Owner’s Representative. Explain use of O&M manual in operating and maintaining systems.

B. Date and time of demonstration will be determined by the Owner.

3.9 CONCRETE

A. All poured in place concrete shall be furnished under the Architectural Divisions of these
Specifications.

3.10 ELECTRICAL EQUIPMENT AND WIRING FOR MECHANICAL DIVISION

A. Unless otherwise indicated, all motors and controls shall be furnished, set in place and wired in accordance with the following schedule. (MD is Mechanical Division - ED is Electrical Division).

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FURNISHED UNDER</th>
<th>SET IN PLACE OR MOUNTED UNDER</th>
<th>WIRED AND CONNECTED UNDER</th>
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<tbody>
<tr>
<td>1.</td>
<td>MD</td>
<td>MD</td>
<td>ED</td>
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<tr>
<td>2.</td>
<td>MD</td>
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<td>3.</td>
<td>ED(a)</td>
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<td>4.</td>
<td>MD</td>
<td>MD(b)</td>
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<td>5.</td>
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<td>6.</td>
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<td>ED(c)</td>
</tr>
</tbody>
</table>

Notes:

a. If furnished as part of factory wired equipment, wiring and connections only by ED.

b. If any of these devices carry the full load current to any motor or resistive element(s) they shall be connected by ED. Control devices carrying full load current furnished by MD and wired by ED shall be located at the device being controlled, unless shown on drawings or mutual agreement is made between the contractors with no change in the contract price.

c. Wiring from alarm contacts to alarm system by ED; all control function wiring by MD. Duct detectors furnished by ED, set in place by MD.

General Note: The above list does not attempt to include all components. All items necessary for a complete system shall be included in the base contract.

B. Connections to all controls directly attached to ducts, piping and mechanical equipment shall be made with flexible connectors.
3.11 IDENTIFICATION

A. Refer to Section 230553 "Identification for HVAC Piping and Equipment" for pipe, duct, and equipment labeling and valve tagging and scheduling requirements.

3.12 FLUSHING, CLEANING & STERILIZING

A. Intent: It is the intent of this specification to require that all work, including the inside of equipment, be left in a clean condition with all dust, grease, and construction debris removed.

1. Piping and connection equipment to be left free of sediments, core sand, grease, etc.
2. Clean all exposed surfaces of piping, ducts and hangers, etc., sufficiently to receive paint. Vacuum ducts as required for debris removal.
3. Air systems shall not be operated without filters. Replace the filters or clean permanent type filters just prior to substantial completion. All air systems shall be furnished with one additional set of filters for owner replacement.
4. Remove and clean all screens, interceptors, strainers, etc., in piping systems just prior to substantial completion.
5. Clean and wipe dry all plumbing fixtures, exposed valves, faucets, and piping, etc. that are exposed just prior to substantial completion. Clean all equipment and fixtures per manufacturer’s specifications to avoid scratching finished surfaces. Leave all plumbing fixtures ready to use.
6. Clean interior and exterior of all air handling equipment of all construction debris. Clean exterior of all exposed ductwork just prior to substantial completion.
7. Thoroughly clean all equipment room floors after completion of equipment, pipe and duct cleaning. A condition of final acceptance will be the cleanliness of all exposed systems, equipment, and equipment rooms.

B. Before final connections are made in the piping systems, blow out all piping with air and then wash out with cleaning compounds. Then flush the system to remove of all foreign materials. Furnish all temporary connections, valves, etc, required for this purpose. Clean the boiler and chiller by the same procedure.

C. Clean the boiler by the same procedure.

D. After flushing, sterilize the domestic water system in accordance with Section 221116.

3.13 TESTING

A. Test all drain and waste lines with standing water test of twelve feet of head, held long enough to visually inspect each joint.

B. Test all heating water and reduced pressure domestic water piping at 150 psig hydrostatic pressure before connecting to unit.

C.

D. Test all high pressure steam and condensate, domestic water service lines to PRV, fire lines, radiant panel (embedded in concrete) and anti-freeze piping at 200 psig hydrostatic pressure.

E. Test all air, oil and gas piping under 60 psig air pressure.
F. Test all refrigeration piping under 150 psig pressure using oil pumped, dry nitrogen and tapping of joints if there is any loss of pressure, soap each joint to find leaks. Charge with 10 psig refrigerant and test with halide torch or electronic leak detector. Evacuate using vacuum pump to 500 microns and purge twice with oil pumped, dry nitrogen.

G. All tests must be done to the satisfaction of the local authorities having jurisdiction, before covering.

H. All hydrostatic tests to be held for a minimum of six hours without loss of pressure. Air tests to be held for a minimum of two hours without loss of pressure.

I. Furnish all instruments required for testing.

3.14 PLACING IN OPERATION

A. Clean all ducts, pipes, equipment, controls etc., of plaster and other foreign debris.

B. Before final acceptance, clean or replace all strainers, oil or grease all bearings and clean out all drains. Clean and recoat all permanent filters, replace throwaway type filters with new filters.

C. The systems shall be put into operation.
   1. The Contractor shall verify that all controls are set to meet operating conditions specified.
   2. The contractor shall verify that all pieces of equipment are operable and that all sequences of control are being met.
   3. The contractor to adjust settings through 1st year as required by MECHANICAL ENGINEER.

3.15 TESTING, ADJUSTING AND BALANCING

A. Refer to Section 230593 Testing, Adjusting and Balancing.

3.16 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Books of Operating and Maintenance Instructions shall be personally delivered to the Owner's authorized representative and the Owner instructed as to their use and the equipment involved. (Provide two books for each building). Also, instruct the Owner's personnel on each valve and the valve chart previously specified.

B. The book shall contain, but not be limited to, the following general items:
   1. Construction phase submittals, including engineer's response and any subsequent revised submittals.
   2. Spare parts lists for each piece of equipment.
   3. Operating manuals for each piece of equipment and control.
   4. Lubrication charts showing type of lubricant and application methods and frequencies.
   5. Filter cleaning or replacement schedule. (On Contractor's letterhead stationary).
   6. Preventive maintenance schedule for checking all items such as belt drive, safety controls and oil and refrigerant charges. Cleaning schedule of all strainers, traps, coils, tubes, tower pans, sprays, etc. (On Contractor's letterhead stationary).
Auraria Higher Education Center  
Tivoli Fit 2 More Classrooms

7. Normal operating instructions including a sequence of operation for each system. (On Contractor's letterhead stationary).
8. Instructions as to procedure to be followed for any emergency situation, such as alarms or safety items being tripped. (On Contractor's letterhead stationary).
9. Instructions on who to call for service during guarantee period. (On Contractor's letterhead stationary).
10. Record of equipment installed (copy of each shop drawing as set forth under "Shop Drawing" Paragraph).
11. All warranties provided by Manufacturers on their equipment that run longer than the one year guarantee by the Contractor.

C. Books shall be arranged in sequence to match the equipment schedules included in the specifications.

D. Approval will not be given for final payment until the tests, balancing and operating instruction portions have been completed.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Special Conditions, and Contract Documents are part of these specifications. Consult them further for instructions and be governed by the requirements contained there under.

1.2 DESCRIPTION

A. Work Included

1. Work shall consist of furnishing all labor, equipment, supplies and materials, unless otherwise specified, necessary for the installation of complete electrical systems as required by the specifications and as shown on the drawings, subject to the terms and conditions of the contract. The work shall also include the completion of those details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems.

1.3 PROVISIONS

A. Work performed under this division of the specifications shall conform to the requirements of Division 1, the electrical drawings, and all items hereinafter specified.

1. Report discrepancies to the Architect in writing and obtain written instructions for the work.

2. Electrical drawings are diagrammatic, but shall be followed as closely as actual construction of the building will permit. All changes from drawings necessary to make the electrical work conform to the building as constructed shall be made without additional cost to the Owner.

3. Coordinate the electrical work with the General Contractor and be responsible to him for satisfactory progress of the same. Coordinate electrical work with all other trades on the project without additional cost to the Owner.

4. All work and materials covered by drawings and specifications shall be subject to review at any time by representatives of the Architect and Owner. If the Architect or Owner’s agent finds any materials or installation that does not conform to these drawings and specifications, Contractor shall remove the material from the premises and correct the installation to the satisfaction of the agent.

5. In acceptance or rejection of installed electrical systems, no allowance will be made for lack of skill on the part of the installers.
1.4 CODES AND STANDARDS

A. The latest editions of the following standards (including supplements and official interpretations) are minimum requirements:

1. NFPA 70 - National Electrical Code (NEC).
5. Conform to all applicable State and Local Codes.
8. Americans with Disabilities Acts (ADA) and American National Standards Institute (ANSI) 117.
9. National Electrical Manufacturer’s Association (NEMA).
10. Underwriter’s Laboratories (UL).
11. Insulated Cable Engineers Association (ICEA).
15. Institute of Electrical and Electronic Engineers (IEEE).

1.5 SPECIAL REQUIREMENTS

A. Definitions: “Provide” shall mean “furnish and install”. “Furnish” means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application. “Install” means to join, unit, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation. The words “accept” or “acceptable” denote only that the equipment items are in general conformance with the design concept of the project.

B. Drawings:

1. The drawings indicate the general arrangement of circuits and outlets, locations of switches, panelboards and other work. Information shown on the drawings is schematic, however, re-circuiting will not be permitted without specific acceptance. Drawings and specifications are complementary to each other. What is called for by one shall be as binding as if called for by both. Data presented on these drawings is accurate as planning can be determined, but accuracy is not guaranteed and field verification of all dimensions, locations, levels, etc., to suit field conditions is directed. Review all Architectural, and Mechanical Drawings and Specifications; adjust all work to conform to all conditions shown therein. The Architectural drawings shall take precedence over all other drawings.

2. Discrepancies between different plans, between plans and specifications, between specifications or regulations and codes governing this installation shall be brought to the attention of the Architect in writing before the date of bid opening. In the event such discrepancies exist, and the Architect is not so notified, the adjudication of responsibility shall be solely at the discretion of the Architect.
1.6 EXAMINATION OF BIDDING DOCUMENTS

A. Each bidder shall examine the bidding documents carefully, and not later than seven days prior to the date of receipt of bids, shall make written request to the Engineer for interpretation or correction of any discrepancies, ambiguity, inconsistency, or error therein which he may discover. Any interpretation or correction will be issued as an addendum by the Architect. Only a written interpretation or correction by addendum shall be binding. No bidder shall rely upon interpretations or corrections given by any other method. If discrepancies, ambiguity, inconsistency, or error are not covered by addendum or written directive, Contractor shall include in his bid, labor materials and methods of construction resulting in higher cost. After award of contract, no allowance or extra compensation will be made on behalf of the Contractor due to his failure to make the written requests as described above.

B. Failure to request clarification during the bid period of any inadequacy, omission, or conflict will not relieve the Contractor of their responsibilities. The signing of the contract will be considered as implicitly denoting that the Contractor has a thorough comprehension of the full intent and scope of the working drawings and specifications.

1.7 PERMITS, FEES & NOTICES

A. Obtain and pay for all necessary permits, inspections and certificates that may be necessary for the full completion of the work. Furnish the Owner with a certificate of final inspection and approval from the AHJ over the electrical installation.

B. Notify proper authorities when work is ready for inspections required by applicable codes, rules and regulations, allowing sufficient time for inspections to be made without hindering progress of the work. Furnish to the Owner copies of inspection certificates of acceptance.

1.8 TESTS

A. Upon completion of all work and adjustment of all equipment, provide complete operational tests of all electrical equipment provided under this division.

1.9 WARRANTY

A. Guarantee that all work governed by this division shall be free of defects in workmanship, materials and parts for a period of one (1) year after written acceptance. Promptly repair, revise, and replace defects as directed with no additional cost to the Owner (lamps and fuses are exempt).

1.10 RECORD DRAWINGS

A. Maintain a current set of electrical drawings at the site. Neatly mark all changes and deviations from the original drawings. Use a color which contrasts with the prints. This shall be a separate set of drawings, not used for construction purposes, and shall be kept up to date as the job progresses and shall be made available for inspection by the Architect at all times. These updated progress drawings shall be used to produce the final record drawings that shall be in AutoCad electronic format media upon project completion.
B. Upon completion of the contract, both sets (electronic and hard copy drawings) of record drawings shall be delivered to the Architect.

C. The Contractor shall mark all record drawings on the front lower right hand corner with a stamp impression that reads 'RECORD DRAWINGS' or similar.

1.11 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by Project conditions.

B. Prior to submitting a bid, visit the site of job and ascertain all conditions affecting the proposed installation and adjust all work accordingly. Make provisions for these costs.

C. Coordinate the work with that of all other trades. Where conflicts of work occur and departure from the indicated arrangements are necessary, consult with other Contractors involved; come to agreement as to changed locations and elevations, etc., and obtain written acceptance from the Architect of proposed changes before proceeding with work.

D. All outages of electrical service shall be scheduled with the Owner five (5) days in advance of proposed outage. Include an overtime allowance in the bid for the performance of all work requiring outages at such time as it is approved by the Owner. Outages shall be at a time and of such duration as accepted by the Owner.

1.12 SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Division 1.

1.13 USE OF THE ENGINEER’S DRAWINGS

A. The Contractor shall obtain, at the Contractor’s expense, from the Engineer a set of AutoCAD or compatible format engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Architect and Engineer a written release of liability acceptable to the Engineer prior to receiving the electronic media.

PART 2 - GENERAL

2.1 STANDARD FOR MATERIALS

A. All materials shall conform to current applicable industry standards. Workmanship and neat appearance shall be as important as the electrical and mechanical operation. Defective or damaged materials shall be replaced or repaired, prior to final acceptance, in a manner acceptable to the Owner at no additional cost to the Owner.

B. All electrical materials shall be acceptable for installation only if labeled or listed by a nationally recognized testing laboratory and if accepted by local authorities.
2.2 SUBMITTALS

A. Submit under provision of Division 1.

B. Listing of Equipment: The Contractor shall submit, within thirty days after the award of the contract, a complete typewritten list of those items of equipment which will be furnished under this contract. Include the name or description of the item, name of manufacturer, model, type, and catalog number.

C. Present shop drawing submittal data at one time, bound in three-ring binders, indexed in a neat and orderly manner. Partial submittals will not be accepted. Do not begin work until (1) copy is returned.

D. Submit five (5) copies of shop drawings, layouts, manufacturer’s data, wiring diagrams and material schedules that may be requested by the Architect for his review. The review by the Architect will not constitute concurrence with any deviation from the plans and specifications unless such deviations are specifically identified by the method described below, nor shall it relieve the Contractor of responsibility for errors or omissions in the submitted data.

E. Processed shop drawings shall not be construed as change orders. The shop drawings shall demonstrate that the Contractor understands the design concept, indicate which equipment and materials he intends to provide, and detail the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between shop drawing submittals and the design drawings and specifications are discovered, the design drawings and specifications shall govern.

F. Contractor shall be responsible for dimensions (which he shall confirm and correlate at the job site), fabrication processes and techniques of construction and coordination of his work with that of other trades. The Contractor shall check and verify all measurements and review shop drawings before submitting them and sign a statement on the shop drawings which signifies that they comply with plans and specifications and that equipment is dimensionally suitable for the application. If any deviations from the specified requirements for any item of material or equipment exist, such deviation shall be expressly stated in writing and incorporated with the submittal. The Owner's copies (two of each) of the reviewed submittals shall be retained by the Contractor until completion of the project and presented in bound form to the Owner.

2.3 BID ALTERNATE(S)

A. Refer to Division 1 and all contract documents for additional information.

B. Alternate(s) for Material and Equipment

1. Equipment and material bid alternate(s) shall be proposed as additive or deductive alternate(s) to specified items by submitting it as a separate line item from the base bid on the Bidder's letterhead.

2. Such bid alternate proposals shall not be substituted or included in the base bid. Bid alternate proposal(s) must be accompanied by full descriptive data on the proposed equipment, together with a statement of the cost to be added or deducted for each item. The bid alternate shall include all materials, equipment, labor, electrical connections, coordination with all other trades, etc. for a complete and operational system.

3. The Contractor shall submit the bid alternates at the time the base bids are due.
2.4 SUBSTITUTION AND APPROVALS (Prior Approvals)

A. Prior to Bidding: Where items of equipment or materials are specified by a manufacturer's name, type, model, or catalog number, only those items may be used in the base bid unless prior written acceptance of other material has been published by addendum.

1. Submit applications for this review in triplicate at least ten (10) calendar days prior to bid opening.
2. Applications for review shall be accompanied by a typewritten list of the specified manufacturer and catalog number and shall state all significant details in which each items differs from the item specified. Failure to list this information shall not relieve the Contractor from providing properly functioning or fitting materials regardless of the review action taken by the Architect. The Contractor will provide only materials which have been specified or accepted prior to bid opening, under his base bid.
3. Equipment and materials not listed as equivalents may be proposed as deductive alternates to specified items by submitting it as a separate line item from the base bid on the Bidder's letterhead.
4. Such substitution proposals shall not be substituted or included in the base bid. Substitution proposal must be accompanied by full descriptive data on the proposed equipment, together with a statement of the cost to be deducted for each item. If any such substitutions are considered, the Contractor shall submit a list of the proposed substitution items within 14 days of award of contract. The request for proposed substitutions shall not be accepted by the Engineer due to scheduling or delivery concerns.

B. Substitutions of Material after Award of Contract

1. Other items of material and equipment may be offered (at the Contractor's option) as alternates to specified items, either as provided for in the Proposal Forms or, if no provisions are made, by submitting it with his bid on the Bidder's letterhead.
2. Such alternate proposal shall not be included under the base bid and must be accompanied by full descriptive data on the proposed equipment, together with a statement of the cost to be added or deducted for each item. If any such alternate material proposals are considered, the Contractor shall submit a list of the proposed alternate substitution items in accordance with the requirements of "Review of Proposed Substitutions".

2.5 SUBSTITUTIONS (CONTRACTOR AND/OR OWNER INITIATED)

A. Materials or equipment listed by several manufacturers’ names are intended to be bidder's choice, and any of the listed manufacturers may be used in the base bid. Materials or equipment not listed are considered substitutions.

B. Performance Specification: When any item is specified by requirement to meet a performance, industry or regulating body standard or is specified generically (no manufacturer's name listed), no prior review by the Consulting Electrical Engineer is needed unless specifically called for in these specifications.

C. Contractor to be responsible for any changes and costs to accommodate any equipment except the first named in the specification.

D. Substitutions for Material
1. Equipment and materials not listed as equivalents may be proposed as deductive
alternates to specified items by submitting it as a separate line item to the base bid on
the Bidder's letterhead.

2. Such substitutions shall not be substituted for the base bid and must be accompanied by
a full description of the difference between the Contract Document requirements and that
of the substitution, the comparative features of each, and the effect of the change on the
end result performance. Include the impact of all changes on other contractors and
acknowledge the inclusion of additional costs to the other trades. If any such alternates
are considered, the Contractor shall submit a list of the proposed alternate substitution
items within 14 days of award of contract. Late requests for proposed substitutions will
not be accepted by the Engineer due to scheduling or delivery concerns.

PART 3 - EXECUTION

3.1 WORKMANSHP AND COMPLETION OF INSTALLATION

A. Contractor's personnel and subcontractors selected to perform the work shall be well versed
and skilled in the trades involved.

B. Coordinate electrical equipment and materials installation with other building components.

C. Sequence, coordinate, and integrate installations of electrical materials and equipment for
efficient flow of the Work. Give particular attention to large equipment requiring positioning prior
to closing-in the building.

D. Any changes or deviations from the drawings and specifications must be accepted in writing by
the Architect/Engineer. All errors in installation shall be corrected at the expense of the
Contractor. All specialties shall be installed as detailed on the drawings. Where detail or
specific installation requirements are not provided, manufacturer's recommendations shall be
followed.

E. Upon completion of work, all equipment and materials shall be installed complete, thoroughly
checked, correctly adjusted, and left ready for intended use or operation. All work shall be
thoroughly cleaned and all residue shall be removed from surfaces. Exterior surfaces of all
material and equipment shall be delivered in a perfect, unblemished condition.

F. Contractor shall provide a complete installation, including all required labor, material, cartage,
insurance, permits, and taxes.

3.2 PROGRESS OF WORK

A. Order the progress of electrical work to conform to the progress of the work of the other trades.
Complete the entire installation as soon as the condition of the building will permit. Any cost
resulting from defective or ill-timed work performed under this Section shall be borne by this
Contractor.
3.3 CHASES, OPENINGS, CUTTING, AND PATCHING

A. Carefully lay out all work in advance so as to eliminate where possible, cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings and roofs. Any damage to the building, structure, piping, ducts, equipment or any defaced finish shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner and to the satisfaction of the Architect. Any necessary cutting, channeling, drilling or anchoring of raceways, outlets, or other electrical equipment shall be performed in a careful manner, and as accepted by the Architect.

B. All openings made in fire-rated walls, floors, or ceilings shall be patched and made tight in a manner to conform to the fire rating for the surface penetrated.

3.4 DELIVERY AND STORAGE OF MATERIALS

A. Arrange and be held responsible for delivery and safe storage of materials and equipment for electrical installation.

B. Store materials and equipment for easy inspection and checking.

C. Carefully mark and store all materials.

D. Deliver materials to the job site in stages of the work that will expedite the work as a whole.

E. Carefully check materials furnished to this Contractor for installation, and provide receipt acknowledging acceptance of delivery and condition of the materials received. Thereafter, assume full responsibility for its safekeeping until the final installation has been reviewed and accepted.

3.5 PROTECTION OF WORK AND PROPERTY

A. Where there are existing facilities, be responsible for the protection thereof, whether or not such facility is to be removed or relocated. Moving or removing any facility must be done so as not to cause interruption of the work of Owner's operation.

B. Close all conduit openings with caps or plugs during installation. Cover all fixtures and equipment and protect against injury. At the final completion, clean all work and deliver in an unblemished condition, or refinish and repaint at the discretion of the Architect.

C. Any equipment or conduit systems found to have been damaged or contaminated above "MILL" or "SHOP" conditions shall be replaced or cleaned to the Engineer's satisfaction.

3.6 FINAL ACCEPTANCE

A. Final acceptance by the Owner will not occur until all operating instructions are received and Owner's personnel have been thoroughly indoctrinated in the maintenance and operation of all equipment.

B. Operating manual, parts lists, and indoctrination of operating and maintenance personnel: Furnish the services of a qualified representative of the supplier for each item or system itemized below who shall instruct specific personnel, as designated by the Owner, in the operation and maintenance of that item or system.
C. Instruction shall be made when the particular system is complete and shall be of the number of hours indicated and at the time requested by the Owner. A representative of the Electrical Contractor shall be present for all demonstrations.

D. Deliver three (3) complete operating manuals and parts lists to the Owner (or his designated representative) at the time of the above required indoctrination. Fully explain the contents of the manuals as part of required indoctrination and instruct the Owner's personnel in the correct procedure in obtaining service, both during and after the guarantee period. The operating manual and parts lists shall give complete information as to whom the Owner shall contact for service and parts, including the address and phone number. Furnish evidence that an authorized service organization regularly carries a complete stock of repair parts for these items (or systems), and that the organization is available for service. Service shall be furnished within twenty four (24) hours after requested.

E. Clean up: Remove all materials, scrap, etc., relative to the electrical installation and leave the premises and all equipment, lamps, fixtures, etc. in a clean, orderly condition. Any costs to the Owner for clean up of the site will be charged against the Contractor.

F. Acceptance Demonstration: Upon completion of the work, at a time to be designated by the Architect, the Contractor shall demonstrate for the Owner the operation of the entire installation, including all systems provided under this contract.

3.7 REMODELING PROVISIONS

A. Existing systems and conditions shown on the drawings are provided for guidance only. The Electrical Contractor shall field check all existing conditions prior to bidding and shall include in his bid an allowance for the removal and relocation of existing conduits, wires, devices, fixtures, or other equipment as indicated on the plans or as required to coordinate and adapt new and existing electrical systems to all other work required for this project.

B. Connect new work to existing in a manner that will assure proper raceway grounding throughout in conformance with the National Electrical Code.

C. Remodel Work Cutting and Patching: The Contractor shall perform cutting, channeling, chasing, drilling, etc., as required to install or remove electrical equipment in areas of remodeling. This work shall be performed so as to minimize damage to portions of wall finishes, surfaces, plastering, or the structure which are to be reused, resurfaced, plastered or painted under another division of these specifications.

D. Carefully coordinate with the required remodeling work, cutting and patching etc., performed by the other trades. Remove or relocate existing electrical conduits, wires, devices, fixtures and other equipment as necessary.

E. All outages on portions of existing electrical systems shall be minimized and shall be at a time and of duration as accepted by the Owner.

3.8 OWNER PROVIDED EQUIPMENT

A. Provide electrical connections to owner furnished equipment.

B. Inspect owner furnished equipment for damage, defects, missing components, etc. Report deficiencies to the Owner immediately. Do not install or connect deficient equipment.
END OF SECTION
SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES
A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. Alpha Wire Company.
   3. Belden Inc.
   5. General Cable Technologies Corporation.

B. Minimum conductor size shall be #12 AWG.

C. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

E. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.
2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. 3M.
2. AFC Cable Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
9. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION
SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1. Burndy; Part of Hubbell Electrical Systems.
      2. Dossert; AFL Telecommunications LLC.
      3. ERICO International Corporation.
      4. Fushi Copperweld Inc.
      5. Galvan Industries, Inc.; Electrical Products Division, LLC.
      6. Harger Lightning and Grounding.
      7. ILSCO.
      9. Robbins Lightning, Inc.
2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
B. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes the following:
      1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS
   A. EMT: Electrical metallic tubing.

1.4 ACTION SUBMITTALS
   A. Product Data: For the following:
      1. Steel slotted support systems.
   B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
      1. Trapeze hangers. Include Product Data for components.
      2. Steel slotted channel systems. Include Product Data for components.

1.5 QUALITY ASSURANCE
   A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
   A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Atkore International.
   g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti, Inc.
         2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc.

     2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
        a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
           1) Cooper B-Line, Inc.
           2) Empire Tool and Manufacturing Co., Inc.
           3) Hilti, Inc.
           4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
           5) MKT Fastening, LLC.

     3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

     4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

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5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
2. To Existing Concrete: Expansion anchor fasteners.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS
A. GRC: Galvanized rigid steel conduit.
B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   3. Anamet Electrical, Inc.
   4. Electri-Flex Company.
   5. O-Z/Gedney.
   6. Picoma Industries.
   7. Republic Conduit.
   8. Robroy Industries.
   10. Thomas & Betts Corporation.
   11. Western Tube and Conduit Corporation.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. FMC: Comply with UL 1; zinc-coated steel or aluminum.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: Setscrew.

F. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Adalet.
   2. Cooper Technologies Company; Cooper Crouse-Hinds.
   3. EGS/Appleton Electric.
   5. FSR Inc.
   8. Kraloy.
   10. Mono-Systems, Inc.
   12. RACO; Hubbell.
   13. Robroy Industries.
   14. Spring City Electrical Manufacturing Company.
   15. Stahlin Non-Metallic Enclosures.
   17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
   1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

H. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: MC can be used for connection of receptacle above ceiling junction boxes in lengths not exceeding 25'-0". All homeruns and branch circuits containing 3 current carrying conductors shall be EMT. For lighting a maximum of 5'-0" of MC cable shall be used from fixture to junction box and in lengths less than 25'-0" between junction boxes. All homeruns and branch circuits containing 3 current carrying conductors shall be EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.
D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer’s written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

N. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
S. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

T. Locate boxes so that cover or plate will not span different building finishes.

U. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

V. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION
SECTION 260544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   5. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
   B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
   C. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
   D. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
   E. Sleeves for Rectangular Openings:

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2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.


4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.


C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.
2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

B. Comply with NFPA 70.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.
C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
B. Colors for Cables Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.
C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.4 CONDUCTOR IDENTIFICATION MATERIALS
A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.

2.5 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.


      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.

   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Indoor occupancy sensors.
      2. Standalone daylight-harvesting switching and dimming controls.
   B. Related Requirements:

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: Show installation details for occupancy and light-level sensors.
      1. Interconnection diagrams showing field-installed wiring.
      2. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Bryant Electric.
      2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Brands Lighting, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D.
12. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Receptacles, receptacles with integral GFCI, and associated device plates.
      2. Snap switches and wall-box dimmers.
      3. Twist-locking Receptacles.
      4. Floor service outlets, poke-through assemblies.

1.3 DEFINITIONS
   A. GFCI: Ground-fault circuit interrupter.
   B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For wiring devices to include in all manufacturers’ packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers’ Names: Shortened versions (shown in parentheses) of the following manufacturers’ names are used in other Part 2 articles:
      1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranded building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 5351 (single), CR5362 (duplex).
   b. Hubbell; HBL5351 (single), HBL5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5361 (single), 5362 (duplex).
   e. Twist-Locking Receptacles.

2.4 GFCI RECEPTACLES

A. General Description:

   1. Straight blade, feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; VGF20.
      b. Hubbell; GFR5352L.
      c. Pass & Seymour; 2095.
      d. Leviton; 7590.
2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following: Catalog numbers in lists below are for 20-A devices; revise catalog numbers to require other configurations and ratings.

   a. Single Pole:
      1) Cooper; AH1221
      2) Hubbell; HBL1221.
      3) Leviton; 1221-2
      4) Pass & Seymour; CSB20AC1

   b. Two Pole:
      1) Cooper; AH1222.
      2) Hubbell; HBL1222.
      3) Leviton; 1222-2.
      4) Pass & Seymour; CSB20AC2.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel
      0.04-inch- (1-mm-) thick, brushed brass with factory polymer finish () (1-mm-).
   3. Poke-through Assemblies.

2.8 FINISHES

A. Device Color:

   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: Stainless Steel.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtailes.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
   1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtailes that are not less than 6 inches in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtailes for device connections.
   8. Tighten unused terminal screws on the device.
   9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers’ device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION
SECTION 265100
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Interior lighting fixtures.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.
B. Related Sections:
   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2. Section 262726 "Wiring Devices" for manual wall-box dimmers.

1.3 DEFINITIONS
A. BF: Ballast factor.
B. CCT: Correlated color temperature.
C. CRI: Color-rendering index.
D. LER: Luminaire efficacy rating.
E. Lumen: Measured output of lamp and luminaire, or both.
F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
   a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
   b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

C. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lighting fixtures.
   2. Suspended ceiling components.
   3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
   4. Other items in finished ceiling including the following:
      a. Air outlets and inlets.
      b. Sprinklers.
      c. Occupancy sensors.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.
1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.
2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.


E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:
   1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
   2. Install lamps in each luminaire.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION
SECTION 26 74 00

ELECTRICAL FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes electrical work required to support the Communications Systems specified in Division 27.

1.2 DESCRIPTION OF WORK

A. The Electrical Contractor shall provide electrical work and equipment as called for in the following Division 27 Specification Sections.

1. Basic Communications Requirements
2. Bidding
3. Quality Assurance
4. Common Work - Sleeves, Penetrations, and Firestopping
5. Common Work - Hangers and Supports
6. Electrical Technology - General Requirements
7. Electrical Technology - Conduit and Boxes

B. The requirements of these Sections are additional to, different from, or otherwise supplement the requirements of similar work specified in Division 26.

C. The requirements of these Sections serve as the basis for the requirements of this Section, and are incorporated by reference into this specification Section.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 26 74 00
SECTION 27 00 10

BASIC COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the basic requirements for Communications Systems installations as indicated or required, and includes requirements common to more than one Specification Section of this Division (such as related documents, related Sections, definitions, governing requirements, Contractor requirements, warranty requirements, submittal requirements/procedures, and project closeout requirements/procedures, as well as other requirements).

1.2 RELATED DOCUMENTS

A. The General Requirements of the Contract (including General and Supplementary Conditions, and the requirements of Division 1), apply to the work of this Division.

B. This Section may expand upon or supplement the General Requirements of the Contract. In the event of a conflict or discrepancy between this Section and the General Requirements of the Contract, the General Requirements of the Contract shall govern. However, if the requirement of this Section (or portion thereof) exceeds that of the General Requirements of the Contract, and is furthermore not contrary to the General Requirements of the Contract, then the requirement of this Section (or portion thereof) shall prevail.

C. Examine the Construction Documents in their entirety (including Drawings and Specification Sections in the other Divisions) for requirements or work which may affect work under this Section, regardless of whether such requirements or work are specifically indicated in this Section.

1.3 RELATED SECTIONS

A. All Specification Sections in this Division.

B. The following Sections in other Divisions:
   1. Division 26 – Electrical for Communications Systems

1.4 COMMUNICATIONS SYSTEMS

A. The following systems are included within this Division. Refer to paragraph DEFINITIONS later in this Specification Section for further explanation of the systems.
   1. Communications Cabling System
   2. Electrical for Communications Systems
   3. AudioVisual Systems
   4. Security System(s)
1.5 INTENT AND INTERPRETATIONS

A. It is the intent of the Construction Documents that the Contractor shall include all items necessary for the proper execution and completion of the Work by the Contractor, resulting in complete and fully operational system(s) ready for the Owner’s use, in full compliance with all applicable standards, codes and ordinances.

1. Work or product not specifically indicated in the Construction Documents, but which are necessary to result in complete and fully operational system(s) ready for the Owner’s use, shall be provided by the Contractor.

2. The specification of certain products in the Construction Documents shall not be construed as a release from furnishing such additional products and materials necessary to furnish complete and fully operational system(s) ready for the Owner’s use.

B. The Construction Documents include certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions include:

1. Abbreviated Language: Language used may be abbreviated. Implied words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpreted as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable and where the full context so dictates.

2. Imperative and Streamlined Language: Imperative and streamlined language is used generally. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

3. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context.

4. Words used in the singular shall also mean the plural, wherever the context so indicates, and likewise words in the plural shall also mean the singular, wherever the context so indicates.

5. Unless otherwise stated, words which have well known technical or construction industry meanings are used in accordance with such recognized meanings.

6. The terms “directed”, “required”, “permitted”, “ordered”, “designated”, or “prescribed”, as well as similar words shall mean the direction, requirement, permission, order, designation or prescription of the Engineer.

7. The terms “approved”, “acceptable”, “satisfactory”, and similar words shall mean approved by, acceptable, or satisfactory to the Engineer.

8. The terms “necessary”, “reasonable”, “proper”, “correct” and similar words shall mean necessary, reasonable, proper, or correct in the judgment of the Engineer.

C. Assignment of Specialists: The individual Specification Sections may require that certain specific construction activities be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and such assignments are requirements.
over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling the contract requirements shall remain with the Contractor.

1. This requirement shall not be interpreted to conflict with the enforcement of local building codes and similar regulations governing the work.

D. Drawings:

1. Drawings are diagrammatic and approximate in character, are not intended to show all features of required work, and do not necessarily indicate every required component.

2. Symbols used on the Drawings are defined in the legend on the Drawings. Symbols indicated on the legend may not necessarily be required.

E. Drawings and Specifications are complementary. Items required by either are binding as though they are required by both.

1.6 DEFINITIONS

A. The definitions below are applicable to this Division:

1. General:

a. Accepted/Acceptable: Work or materials conforming with the intent of the project, and in general, conforming to the pertinent information in the Construction Documents.

b. Approved/Approval: The written approval of the Engineer.

c. Accessible: Easy access. Access attained without requiring extensive removal of other materials to gain access.

d. Accessible Ceiling: Acoustical tile hanging ceilings (“Hard-lid” ceilings (concealed spine or sheetrock/gypsum ceilings), even when provided with access panels, are not considered an Accessible Ceiling.)

e. Agreement: The contractual agreement between the Owner and the Contractor.

f. By Others: A party or entity other than the Contractor. The Contractor shall engage the General Contractor, Architect, and/or Owner to determine this party or entity for consideration of pricing and/or execution of the Work.

g. Concealed: Hidden from sight in interstitial building spaces, chases, furred spaces, shafts, crawl spaces, etc.

h. Construction Documents: Collective term for the entire set of bound or unbound material describing the construction and services required, including all Drawings, Specifications, addenda issued prior to execution of the contract, and modifications issued after execution of the Contract (such as change orders, construction change directives, supplemental instructions, etc.).

i. Contract Documents: The Agreement (including other documents listed in the Agreement), Conditions of the Contract (General, Supplementary and other conditions), and the Construction Documents.
j. The Contract: The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the Owner and the Contractor and supersedes any prior negotiations, representations or agreements, either written or oral. The Contract shall not be construed to create a contractual relationship of any kind (1) between the Engineer and the Contractor, (2) between the Owner and a subcontractor, or (3) between any persons or entities other than the Owner and Contractor.

k. Contractor: The party responsible for providing the system(s) as indicated herein.

l. Drawings: The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including (but not limited to) plans, elevations, sections, details, schedules and/or diagrams.

m. Engineer: The party responsible for producing the communication system(s) Construction Documents.

n. Exposed: Not concealed (see above) and not installed underground.

o. Final Completion: The date when the Engineer confirms in writing that the Contractor has completed the work in accordance with the Construction Documents, including completion of all punch list items, cleanup work and delivery of all required guarantees, warranties, licenses, releases and other required deliverables.

p. Furnish: To purchase, supply, and deliver to the project materials in new and operable condition, ready for installation.

q. Governing Requirements: Collective term for regulations, laws, ordinances, codes, rules, standards, requirements, guidelines, and recommendations that govern the installation and inspection of the work defined in the Contract Documents.

r. Governing Authority: Entities or their representatives charged with formation and/or enforcement of Governing Requirements, such as the Authority Having Jurisdiction (AHJ).

s. Install: To place in final position in fully operable, tested condition.

t. Inside Plant (ISP): Infrastructure within a building.

u. Or Equal: Materials approved for use by the Engineer and which are dimensionally suitable and operationally identical to the specified item.

v. Outside Plant (OSP): Infrastructure exterior to a building.

w. Owner: The Owner and the Owner’s designated representative(s).

x. The Project: The total construction of which the Work performed under the Contract Documents may be the whole or a part, and which may include construction by the Owner and/or separate Contractors.

y. Provide: To furnish and install, complete, tested and ready for intended use.

z. Rough-in: Provide the Communications Pathway System, including (but not limited to) device boxes, pull boxes, wall boxes, floor boxes, poke-through devices, conduit, enclosures, cable tray, ducts/ductbanks, maintenance holes, hand holes, and other pathways and items indicated (or as required) for routing, supporting, and installing communications.
cables, devices, or equipment which shall be provided by others or provided under a subsequent set of Contract Documents.

aa. Substantial Completion: The date when all work required by the Construction Documents shall be complete (subject to the final punch list to be prepared by the Engineer) and on which the applicable jurisdictional authorities have issued a temporary certification of occupancy.

bb. Section: An individual Section of the Specifications.

c. Shown on Drawings: Noted, indicated, scheduled, detailed, or any other written reference made on the Drawings.


e. Specification Section(s): One or more Sections of the Specifications.

ff. Section(s): An abbreviated form of Specification Section(s).

g. The Work: The construction and services required by the Contract Documents, whether completed or partially completed, and all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.

2. Communications Systems Specific:

a. Communications Cabling System: Includes (but is not limited to) communications cables and patch cables, connectors, terminations and termination equipment and panels, equipment racks and distribution equipment, equipment required for the build-out of communications rooms and spaces, and other incidental and miscellaneous product and labor as required.

b. Communications Infrastructure System: A Communications Cabling System in conjunction with a Communications Pathway System.

c. Electrical for Communications Systems

1) Communications Pathway System: Includes (but is not limited to) device boxes, pull boxes, conduit, cable tray, duct/ductbank, and other pathway and raceway components necessary to provide pathway for, support, and route communications cables.

2) Telecommunications Bonding and Grounding System: Includes (but is not limited to) providing a permanent grounding and bonding infrastructure for the Communications Cabling System.

3) Commonly referred to as Electrical Technology in the Division 27 Construction Documents.

d. AudioVisual Systems: TBD

e. Security System: Includes (but is not limited to) security cables, connectors, terminations and termination equipment, security equipment, equipment racks, equipment required for
system configuration, programming and testing, and other incidental and miscellaneous product and labor as required.


3. Owner Specific: The Contractor shall comply with the following Owner requirements. These requirements shall be incorporated by reference into these Specifications and shall be hereinafter considered a Governing Requirement:


   b. The contractor shall obtain a copy of this standard and fully review it prior to providing their bid for the work shown in the Technology Construction Documents.

1.7 ABBREVIATIONS

   A. ACTC: Auraria Cooperative Telecommunications Committee

   B. Refer to the individual Specification Sections and Drawings for abbreviations and their definitions.

1.8 GOVERNING REQUIREMENTS

   A. All work shall be executed in compliance with the applicable portions of the following Governing Requirements:

      1. General

         a. ACI: American Concrete Institute (www.aci-int.org)

         b. AHJ: Authority Having Jurisdiction

         c. ANSI: American National Standards Institute (www.ansi.org)

         d. ASTM: American Society for Testing and Materials (www.astm.org)

         e. BELLCORE: Bell Communications Research (www.telecorrdia.com)

         f. BICSI: A Telecommunications Association (www.bicsi.org)

         g. ETL: Electrical Testing Laboratories

         h. IBC: International Building Code

         i. ICEA: Insulated Cable Engineers Association (www.icea.net)

         j. IEEE: Institute of Electrical and Electronic Engineers (www.ieee.org, www.standards.ieee.org)

         k. IES: Illuminating Engineering Society of North America (www.iesna.org)

         l. IFC: International Fire Code
m. FCC: Federal Communications Commission Rules and Regulations
n. NAB: National Association of Broadcasters
o. NFPA: National Fire Protection Association (www.nfpa.org)
r. NEMA: National Electrical Manufacturers Association (www.nema.org)
s. OSHA: Occupational Safety and Health Administration (www.osha.gov)
t. RUS: Rural Utilities Service (http://www.usda.gov/rus/)
w. State and local codes, ordinances, and regulations
x. Requirements and guidelines of local utility companies
y. Applicable state, local and/or federal laws, regulations, and/or specifications
z. Manufacturer installation requirements, guidelines and recommendations

2. Communications System Specific: The following portions of the General Governing Requirements above are particularly relevant to a given Communications System. Omission from this list does not alleviate the Contractor from responsibility for executing all Work for all Communications Systems in compliance with all applicable portions of the Governing Requirements above:
   a. Communications Cabling System:
      1) TIA/EIA 568: Commercial Building Telecommunications Cabling Standard
      2) TIA/EIA 569: Commercial Building Standard for Telecommunication Pathways and Spaces
      3) TIA/EIA 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
      4) ANSI/NECA/BICSI 607: Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
      5) ANSI J-STD-607: Commercial Building Grounding and Bonding Requirements for Telecommunications
      6) TIA/EIA 758: Customer-owned Outside Plant Telecommunications Cabling Standard
      7) ANSI/EIA 310-D: Cabinets, Racks, Panels and Associated Equipment
      8) TIA/EIA: Technical Service Bulletins (TSBs) (related to the above TIA/EIA standards)
9) IEEE 802.3 (series): Local Area Network Ethernet Standards
10) BICSI: Customer Owned Outside Plant Design Manual
13) BICSI: Telecommunications Distribution Methods Manual
15) NFPA 70: NEC: National Electrical Code (NFPA Article 70)
16) NFPA 75: Protection of Electronic Computer and Data Processing Equipment
17) NFPA 78: Lightning Protection Code
18) FCC Part 68: Connection of Terminal Equipment to Telephone Network.
19) FCC Part 76.611: CFR Title 47 Radiation Leakage Standards

b. Electrical for Communications:
   1) TIA/EIA 569: Commercial Building Standard for Telecommunication Pathways and Spaces
   2) TIA/EIA 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   3) ANSI/NECA/BICSI 607: Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   4) ANSI J-STD-607: Commercial Building Grounding and Bonding Requirements for Telecommunications
   5) TIA/EIA 758: Customer-owned Outside Plant Telecommunications Cabling Standard
   6) TIA/EIA: Technical Service Bulletins (TSBs) (related to the above TIA/EIA standards)
   7) BICSI: Customer Owned Outside Plant Design Manual
   8) BICSI: Telecommunications Cabling Installation Manual
   9) BICSI: Telecommunications Distribution Methods Manual
   10) NFPA 70: NEC: National Electrical Code (NFPA Article 70)
   11) NFPA 75: Protection of Electronic Computer and Data Processing Equipment
   12) NFPA 78: Lightning Protection Code
   13) UL 467: Grounding and Bonding Equipment

c. Low Voltage System(s):
   1) Refer to the applicable specification section for each Low Voltage System.

3. Owner Specific: The Contractor shall comply with the following Owner requirements. These requirements shall be incorporated by reference into these Specifications and shall be hereinafter considered a Governing Requirement:
a. Auraria Cooperative Telecommunications Committee – Universal Cable Plant IT Services – *Building Infrastructure Distribution Systems Guidelines, Methods and Standards* (latest edition)

B. Nothing in the Governing Requirements and Construction Documents shall be construed to permit work not conforming to all governing codes and regulations.

C. Errors or omissions in the Construction Documents do not relieve the Contractor from executing the work in accordance with the Governing Requirements, including all governing codes and regulations.

D. The applicable portions of the Governing Requirements shall be incorporated by reference into each related Specification Section in this Division.

1.9 PERMITS AND FEES

A. The Contractor shall obtain and pay for all licenses, permits and inspections required by the laws, ordinances and rules governing work specified herein. Such fees shall be included in the bid amount.

B. The Contractor shall pay all fees, including but not limited to fees for local utility service installation, connection charges, etc. Such fees shall be included in the bid amount.

C. Notations on permit or review documents shall be observed. Additional requirements noted by the Governing Authority shall be made part of the requirements for construction of the Project. Additional costs for implementing these requirements, if any, shall be submitted for review prior to construction.

D. Engineering Fees: The Specifications may identify work required of the Engineer due to improper action(s), lack of action(s), and/or deficiencies on the Contractor’s part. Such instances will be identified in the Specifications and the Contractor shall be responsible for these fees if they are incurred by the Engineer.

1. Fees charged to the Contractor will be at the Engineer’s billing rates at the time the services are performed. Travel time will be included, if applicable. Mileage will be charged for required automobile travel at the standard IRS mileage rate in effect at the time the services were performed. Expenses will be billed at cost plus 10 percent markup.

2. Fees will either be paid directly to the Engineer or will be deducted directly from payments (or the final payment) to the Contractor.

1.10 SUBSTITUTIONS AND DEVIATIONS

A. All substitution requests must be submitted to ACTC for written approval prior to inclusion in the project.

1. Substitutions shall only be allowed with prior submittal of all component specifications to the committee in advance of bid due dates. Unanimous agreement by committee members and complete verified interoperability with any existing cabling system already in place within the building or project area in question is required.

B. The requirements below expand upon and/or supplement the requirements in Division 1.

C. Substitution of product and deviations from the methods of construction specified which are used in the Contractor’s bid shall be at the sole risk of the Contractor, and as such are subject to rejection without consideration.

D. Proposed deviation requests shall be reviewed during the time of Submittal review:
1. Conditions for Consideration: Deviation requests will be received and considered only when one or more of the following conditions are satisfied:
   a. A substantial advantage is offered to the Owner, in terms of cost, time, or other considerations of merit.
   b. The specified product or method of construction cannot be provided with the contract period.
   c. The specified product or method of construction cannot receive necessary approval by a Governing Authority, and the requested deviation can be approved.
   d. The specified method of construction cannot be provided in a manner that is compatible with other materials.
   e. The manufacturer of specified product has ceased business practices.
   f. The product as specified includes the statement, “Or Equal.”

2. Conditions for Rejection: Substitution and deviation requests will be rejected for the following reasons, among others:
   a. The conditions for consideration (see above) have not been met.
   b. Extensive revisions to the Construction Documents are required to support the proposed changes.
   c. The proposed changes do not comply with the general intent of the Construction Documents.
   d. The substitution request is for product which does not include the statement, “Or Equal”, or is specified as “no substitute”, “substitutions are not acceptable”, “provide as specified” or similar.
   e. The deviation is not of equal or greater value as specified product or design.
   f. The proposed change is solely for the convenience or economic gain of the Contractor.

E. The Contractor shall not proceed with procurement or installation of a substitution or deviation without written approval.

   1. Upon approval of the request, the Contractor shall be responsible for fees incurred by the Engineer for re-design work or modifications to the Construction Documents if necessitated by the nature of the request.

1.11 SUBMITTALS

A. The requirements below expand upon and/or supplement the requirements in Division 1.

B. General:

   1. Submittal review is a courtesy extended to the Contractor for the limited purpose of checking for general conformance with the design concept and the information shown in the Construction Documents.
2. Prior to submission of any product or methods of construction submittal items, submit a Submittal Schedule indicating items to be submitted with respective dates. Schedule shall allow the Engineer's possession of each submittal per the Division 1 Submittal Procedures specification section. Schedule shall clearly indicate submittal items that will contain a “Substitution and Deviation Requests” section (see below) including a statement indicating condition for consideration of such as listed under requirements of Part 1 – General: Substitutions and Deviations herein.

3. The Contractor shall provide submittal information as soon as practicable after the date of Notice to Proceed and prior to the purchase, delivery, fabrication, and installation of product and materials.

4. In the event of discrepancies or conflict between Submittals and the Construction Documents, either prior to or after review, the requirements of the Construction Documents shall prevail.

5. Submission of material for review, regardless of the outcome of the review, does not alter the Contractor’s obligation to follow the intent of the Construction Documents, nor the Contractor’s responsibility to comply with the Construction Documents.

6. Submittals will not be reviewed and will be returned to the Contractor without review for the following reasons:
   a. Submittal package does not conform to the requirements listed herein.
   b. Submittal is for a product or method of construction not required by the Construction Documents.
   c. Submittal is partial or incomplete. For example, a submittal shall be considered partial or incomplete if Product Data is not accompanied by related Shop Drawings.
   d. Submittal contains information concerning the proposed implementation of means, methods, procedures, sequences or techniques, temporary aspects of the construction process, or other items, which are the sole responsibility of the Contractor.
   e. Submittal was not carefully reviewed by the Contractor prior to submission, as evidenced by poor organization, obvious or numerous errors, lack of correlation or cross-referencing, lack of clarity in presentation, or containing Shop Drawings which do not meet the standard of the Construction Drawings.
   f. Submittal was submitted directly from the Contractor’s subcontractor(s) or vendor(s).
   g. Subcontractor and/or vendor submittal information was not carefully reviewed and/or approved by the Contractor.
   h. Submittal does not bear the Contractor’s approval stamp, and/or contains subcontractor and/or vendor submittal information which does not bear the Contractor’s approval stamp.
   i. Submittal contains substitution and/or deviation requests, which are not clearly identified as substitution or deviation requests in a separate “Substitution and Deviation Requests” section of the Submittal.

7. Submittals shall be submitted as a single package and shall include subcontractor and vendor submittal information.
8. Each submittal (or re-submittal) set shall bear a unique Contractor’s submittal sequence number.
9. Requests for substitution shall only be included under the “Substitution and Deviation Requests” section of the submittal (see below) and shall comply with the requirements of Part I – General: Substitutions and Deviations herein. Submission of substitution requests in any other portion of the Submittal does not constitute an acceptable or valid request for substitution, nor will review of such information constitute approval in any manner.

C. Submittal Format:

1. Submittals shall be bound in one letter-sized (8-1/2 inch by 11 inch) document and under separate cover from submittals furnished under other Divisions.
2. Front cover of Submittal shall indicate the name of the project, the project number, the name of the Owner, year of completion, the title “Telecommunications Submittals”, and the names of the Engineer and Contractor, as well as the General Contractor.
3. Submittals shall include a table of contents identifying sections, Specification Sections, and page numbers.
4. Information provided in the submittal shall follow the same general order of the Specifications.
5. Submittals shall be sectionalized (Indexed with titled tab dividers (by section name – not numbered and not handwritten).
   a. Sections shall be (see Submittal Sections below for more detail regarding each section):
      1) Product Data
      2) Shop Drawings
      3) Samples
      4) Substitution and Deviation Requests
      5) Test Reports
      6) Other Information
   b. Within each section, information shall be organized by Specification Section and/or Drawing to which the information applies.
   c. Within each section, where section is not applicable (e.g. shop drawings, technical drawings, etc.), the section shall include a page denoting same.
6. Pages shall be numbered.
7. Drawings (except for full and half-size Shop Drawings), if not in 8-1/2 inch by 11 inch size, shall be bound and accordion folded to 8-1/2 inch by 11 inch size.
8. Quantity: Submit copies in quantities per the requirements of Division 1.

D. Submittal Sections: Submittals shall be sectionalized and shall include sections for Product Data, Shop Drawings, Substitution and Deviation Requests, and Samples, Other Information (see Submittal Format herein).

1. Product Data: Submit Product Data information as called for in the individual Specification Sections. Product Data shall include:
a. For all product, provide the following product information (as applicable):
   1) Specification Section to which the product applies.
   2) Catalog cut sheets, manufacturer data sheets, and/or specification sheets detailing
      the product, item, assembly and installation.
   3) Manufacturer’s printed recommendations (if not included in the above).
   4) Written description.
   5) Notation of dimensions verified by field measurement.
   6) Notation of coordination requirements.
   7) Compliance with recognized trade association and testing agency standards.
   8) Highlighted details within the product data that identifies compliance with the
      Construction Documents or the intent of the Construction Documents.
   9) Highlighted details within the product data that identifies deviations from the
      Construction Documents or the intent of the Construction Documents.

b. For products for which the Contractor is proposing a substitution, include the product as
   specified in the Submittal per the above requirements and list the reference to the proposed
   substitution in the “Substitution and Deviation Requests” section of the Submittal (see
   below).

c. Do not provide product quantities – quantities are the sole responsibility of the Contractor
   and will not be reviewed.

2. Shop Drawings: Submit Shop Drawings that are newly prepared, drawn to accurate scale, and
   that fully illustrate the Contractor’s understanding of the intent and requirements of the Construction
   Documents (i.e. Shop Drawings shall not be based upon or consist of a reproduction of the
   Construction Documents or standard printed data). Submit Shop Drawings as called for in the
   individual Specification Sections. Shop Drawings shall include:

   a. Identification of products and materials

   b. Schedules, including but not limited to:
      1) Equipment and components
      2) Cables: identify manufacturer, model number, outside diameter and connector

   c. Notation of coordination requirements

   d. Notation of dimensions established by field measurement

   e. Notation of details that identify compliance with the Governing Requirements

   f. Notation of details that identify compliance with the Construction Documents or the intent
      of the Construction Documents.

   g. Notation of deviations from the Construction Documents or the intent of the Construction
      Documents. Highlight, encircle, or otherwise clearly indicate such deviations

   h. Roughing-in and setting diagrams

   i. Fabrication, installation, and adaptation details including, but not limited to:
1) Electronic equipment to be mounted within racks
2) Cable routing between electronic equipment in racks or housings
3) Equipment to be mounted within furniture
4) Wall and ceiling mounted devices
5) System labels, including but not limited to engraved, lamacoid, silk screen and paper labels
6) Suspended loudspeaker mounting, including but not limited to tilt angle, splay angle, height above finished floor, coverage pattern, and assembled weight
7) Non-standard manufactured or adapted equipment
8) Dimensions
9) Other details as necessary to establish the intent of the Construction Documents

j. One-line diagrams detailing the interconnections of system components, including the identification of all devices, cabling, terminations, and termination techniques as required for fully functional systems

k. Applicable software block diagrams representing the internal operation of devices such as, but not limited to, control processors and digital signal processors

l. Templates

m. Floor plans identifying equipment locations, if not shown on the Construction Documents

n. Reflected ceiling plans identifying equipment locations, if not shown on the Construction Documents

o. Indication of sectionalized manufacturing of equipment (i.e. for oversized equipment that cannot be installed as a single component).

p. Shop drawings shall be provided in form, format and size identical to that of the Construction Drawings (the Construction Drawings set the standard). Shop Drawings that do not meet this standard shall be rejected without review.

1) Title Block: May be the Contractor’s Title Block, but shall indicate Project name, manufacturer’s name and logo, date of submittal, content of sheet, and sheet number.
2) Floor Plans: Plan titles, scales, north arrows, column lines, line types, fonts, and room names and numbers shall match that of the Construction Drawings.

q. For methods of construction for which the Contractor is proposing a deviation, include the method of construction as specified per the above requirements and list the reference to the proposed deviation in the “Substitution and Deviation Requests” section of the Submittal (see below).

3. Substitution and Deviation Requests: For each substitution and/or deviation request, include the following:

a. Whether the request is for substitution of product or a deviation from a construction method.

b. The Specification Section(s) or Drawing to which the request applies.
c. Reason for the request. (Note: the reason must conform to the requirements of Part 1 – General: Substitutions and Deviations herein.)

d. If a substitution, provide:
   1) Specified product to which the proposed substitution applies.
   2) Product Data for the substituted product.
   3) Notation of differences between the proposed substitution and the specified item. Highlight, encircle, or otherwise clearly indicate the substitution.

e. If a deviation, provide:
   1) Specified Drawing and/or method of construction to which the proposed deviation applies.
   2) Shop Drawings showing the deviation.
   3) Notation of differences between the proposed deviation and the specified drawing and/or construction method. Highlight, encircle, or otherwise clearly indicate the deviation.

f. Written statement signed by the Contractor stating that the proposed substitution or deviation is equivalent or superior in function, appearance, and quality to the specified product or construction method and that the proposed substitution or deviation will be at no additional cost to the Owner.

4. Samples: Submit Samples as called for in the individual Specification Sections.
   a. Samples shall be indexed in this section and provided as an attachment to the Submittal.

5. Test Reports:
   a. Submit full-size mock-ups of the test reports that will be used to document the testing.

6. Other Information:
   a. Contractor Statement of Qualifications, per Division 27 Specification Section Contractor Qualifications.
   b. Bid Form or Bid Supplement Form, per Division 27 Specification Section Bidding.
   c. Owner Specific: Submit other information as required by Owner Specific Governing Requirements.
   d. Submit additional information as called for in the individual Specification Sections.

E. Submittal review:

1. The submittal review will not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of work with other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor.

2. Corrections or comments made on the Submittal by the reviewer during the submittal review do not relieve the Contractor from compliance with the requirements of the Construction Documents.
3. Review of a specific item shall not indicate that the reviewer has reviewed the entire assembly of which the item is a component.

4. Review does not relieve the Contractor from responsibility for errors, which may exist in the submitted data.

5. Review of substitutions and deviations:
   a. The reviewer shall not be responsible for review of substitutions and/or deviations that were not brought to the attention of the reviewer by specific inclusion of the substitution and/or deviation in the Substitution and Deviation Requests section of the Submittal.
   b. Where a substitution and/or deviation is not included in the Substitution and Deviation Requests section of the Submittal, the procurement and installation of the substitution and/or deviation is at the sole risk of the Contractor.
   c. If the reviewer does not specifically note substitutions and/or deviations, it remains the Contractor’s responsibility to comply with the Construction Documents.

6. After review, submittals shall be returned together with review comments and specific actions (if required) to be taken by the Contractor. Typical comments and actions will be:
   a. No Exception Taken
   b. Revise - Resubmittal Required
   c. Revise - Resubmittal Not Required
   d. Submit Specified Item
   e. Rejected
   f. Not Reviewed

7. The Contractor shall perform no portion of the Work requiring a submittal until the respective submittal has been reviewed and approved. Such Work shall be in accordance with the approved submittal.

F. Re-submission of submittals:
   1. Submittals shall continue to be re-submitted and reviewed until all submitted items are marked by the Engineer as ‘No Exceptions Taken’ or ‘Revise - Re-submittal Not Required’.
   2. Re-submittals shall be clearly identified as a re-submittal and shall identify changes on a separate Revisions page inserted after the Table of Contents page(s).
   3. The Contractor shall be responsible for fees incurred by the Engineer resulting from subsequent review of re-submittals that fail to meet the requirements herein. Such fees will be incurred after the Engineer has reviewed the original submission and one re-submission.
   4. Re-submittals do not entitle the Contractor to additional time, nor are they considered cause for delay of the project.

1.12 RECORD DOCUMENTS
A. The requirements below expand upon and/or supplement the requirements in Division 1.

B. The Contractor shall maintain a set of Record Documents showing all additions, changes, and deletions that have been made to the original Drawings and Specifications throughout the course of construction, as well as reviewed Submittal data, including but not limited to Shop Drawings.

1. Items to be noted shall include but shall not be limited to:
   a. Final device box, pull box, floor box, sleeve and conduit stub/poke thru locations
   b. Final locations, sizes, and dimensions of equipment, including concealed equipment
   c. Routing of concealed raceways/pathways
   d. Raceways/pathways located more than 2 feet from where shown on the original Construction Documents
   e. Raceways and main pathways (pathways with more than 30 cables) not shown on the Drawings
   f. Building outline changes
   g. Addenda, accepted Alternates, Change Orders, other document revisions which occurred after the award of the Contract and/or the start of construction activities
   h. System component labels (including outlet numbers) and identifiers for all major components
   i. Shop Drawings, including those submitted for approval and those used for construction but not required for submission.

2. Notations shall be in a neat, legible and logical manner. Areas affected by the change shall be clouded.

C. Record Documents shall:

1. Be kept current (i.e. no more than one week behind actual construction) throughout the course of construction.
2. Be retained at the job site until Final Acceptance.
3. Be made readily available at all times to the Owner’s representative.
4. Not be the Contractor’s working documents.
5. Be protected from deterioration and loss in a secure, fire-resistive location.
6. Be made readily available to the Engineer for review of completeness and accuracy throughout the course of construction.
7. At project closeout, be updated with the items on the Known Exceptions/Deviations List per the requirements of Part 3 – Execution: Project Close-Out, herein. Include only those items marked “Approved” by the Engineer.
D. Submission:
   1. Unless otherwise indicated, handwritten notations on Record Drawings shall be submitted to Engineer during Project Close-Out site visit.
   2. The Record Drawings shall be reviewed by the Contractor for accuracy and completeness prior to submission.

E. Owner Specific:
   1. Submit other information as required by Owner Specific Governing Requirements.

F. Submit additional information as called for in the individual Specification Sections.

1.13 OPERATING AND MAINTENANCE (O&M) MANUALS

A. General:
   1. O&M Manuals shall be submitted in accordance with the applicable portions of Division 1.
   2. O&M Manuals shall be submitted as a single package and shall include subcontractor and vendor O&M information.
   3. O&M Manuals shall be prepared by personnel who are:
      a. Completely familiar with the requirements of this Section
      b. Trained and experienced in the maintenance and operation of the described products
      c. Skilled as a technical writer to the extent required to communicate essential data
      d. Skilled as a draftsperson competent to prepare the necessary Drawings
   4. Catalog pages and data included in O&M Manuals shall be originals. Where not possible to obtain original copies in sufficient quantity, catalog pages and data shall be neat, clean copies of the originals.
   5. O&M Manuals shall include the following:
      a. Table of Contents
      b. Operations: Assemble operations and instructions data which shall include all procedures necessary for activating and controlling each system and/or component in all modes of operation and for fulfilling all functional requirements.
      c. Product Data: Include the product data provided in the original Submittal(s) reflecting product as supplied and installed, as well as additional information such as manufacturer, installation, operation, routine maintenance information, and technical specifications.
      d. Shop Drawings: Include the Shop Drawings provided in the original Submittal(s) reflecting the system and/or components as installed.
      e. Service Information: Assemble service information (cleaning, adjustments, frequency, etc.) for each device requiring service. For devices requiring qualified service, compile an index
of qualified service providers (and their contact information) able to service these devices. Provide a recommended maintenance schedule for each device.

f. Spare Parts: Assemble a list of spare parts. Compile an index of spare parts providers (and their contact information) able to provide the spare parts.

g. Tests Results: Assemble all test documentation made for each system, device, and/or component requiring testing.

h. Calibration/Configuration Settings: Assemble and document all calibration/configuration settings made for each system, device and/or component requiring calibration and/or configuration. Include ‘normal’ settings for each component.

i. Record Documents: Provide Record Documents per the requirements of Part 1 – General: Record Documents herein.

j. Final punchlist: Provide the final punchlist including all corrective action taken and Contractor initials per the requirements of Part 3 – Execution: Project Close-Out.

k. Certificates of Inspection: Provide certificates of inspection and final approval from all applicable Governing Authorities, the Manufacturer(s), the Contractor’s RCDD, etc.

l. Warranty: Provide warranty documentation per the requirements of Division 27 Specification Section Warranty and the individual Specification Sections.

m. Software, including but not limited to:
   1) All source code for custom programs. Source code shall be provided on CD-ROM.
   2) System software
   3) Computer system operating software
   4) Application software
   5) Version Documentation: Provide a spreadsheet in MS Excel format documenting all software and firmware versions for all programmable devices. Provide in both printed format and on CD-ROM.

n. Other Information:
   1) Submit additional information as called for in the individual Specification Sections.
   2) Owner Specific: Submit other information as required by Owner Specific Governing Requirements.

6. O&M Manual contents shall also be submitted in both hard copy and soft copy on CD-ROM.

B. O&M Manual format:

1. O&M Manuals shall be bound in one letter-sized (8-1/2 inch by 11 inch) hard cover (hard back or loose leaf) binder.

2. Separate O&M Manuals shall be provided for each communications system (i.e. Communications Cabling System, Low Voltage – In-building Wireless System, Security, etc.)

3. Front cover of the O&M Manual shall indicate the name of the project, the project number, the name of the Owner, the title of the O&M Manual indicating the communications system
(Communications Cabling System O&M Manual, Low Voltage – In-building Wireless System O&M Manual, Security System O&M Manual, etc.), the year of completion, the name of the Engineer, the name of the Contractor, and as applicable the names of the Architect and the General Contractor.

4. Side cover of the O&M Manual shall indicate the name of the project, the project number, the name of the Owner, and the title of the O&M Manual.

5. O&M Manual shall include each section defined under O&M Manual Requirements above.

6. O&M Manuals shall include tab dividers, titled (not numbered) for each section. Tab dividers shall not be handwritten.

7. O&M Manuals shall include a table of contents identifying sections and page numbers.

8. Pages within each section shall be numbered.

9. Drawings (excluding full size Record Drawings) shall be bound and accordion folded to 8-1/2 inch by 11 inch size.

C. O&M Manual submission:

1. The Contractor shall submit one draft copy of the O&M Manual for review and approval by the Engineer.

   a. The submission will be reviewed for accuracy, completeness, and compliance to the requirements herein. A submission which fails to meet these requirements will be rejected and returned to the Contractor together with review comments and specific actions to be taken by the Contractor. The Contractor shall revise the O&M Manual and re-submit for review and approval.

   b. The O&M Manual shall continue to be re-submitted and reviewed until such time as the O&M Manual is approved by the Engineer.

   c. The Contractor shall be responsible for fees incurred by the Engineer resulting from subsequent review of O&M Manuals that fail to meet the requirements herein. Such fees will be incurred after the Engineer has reviewed the original submission and one re-submission.

2. Upon approval of the draft copy, the Contractor shall submit final copies in quantities per the requirements of Division 1.

D. Final payment to the Contractor will not be authorized until the final copies of the O&M Manuals (including Record Documents) have been received and approved by the Engineer.

PART 2 - MATERIALS

2.1 GENERAL

A. Where one or more products are listed for a specified component:

   1. The product listed first shall establish size, capacity, grade, quality, technical specifications, and the basis of design.
2. Products not listed first shall be considered “other acceptable” products. Should the Contractor choose to use those products, costs for changes to the construction required to support the use of these products shall be borne by the Contractor.

B. If no product is listed, then any manufacturer able to meet the listed Specifications is acceptable.

C. The Contractor is responsible for providing submittals for product as indicated and shall comply with the requirements of Part I – Submittals herein. Substitutions shall comply with the requirements of Part I – General: Substitutions and Deviations herein.

D. Unless otherwise indicated, where product is specified without the statement “or equal”, substitutions will not be considered.

2.2 MATERIALS

A. The Contractor is responsible for providing all incidental and/or miscellaneous tools, scaffolding, consumable items, testing equipment appliances, and other hardware not explicitly specified or shown on the Drawings required for the installation of a complete and operable systems ready for the Owner’s use.

B. Products shall be:

1. New and unused, free from blemish and defects.

2. Standard products of manufacturers regularly engaged in the production of such products.

3. Of the manufacturers latest standard design at the time of procurement,

4. Designed to ensure satisfactory operation and life in the environmental conditions that prevail in their installation location.

5. Designed for application in commercial/professional systems, except as otherwise specifically noted.

C. All products, whether stock or custom, shall be supported by replacement parts and manufacturer schematic drawings as applicable. “Black box” and/or unidentified components are not acceptable.

D. All products of the same or similar type shall be the product of one manufacturer.

E. All component products within a unified system shall be the product of one manufacturer.

F. Equipment shall be UL listed, or equivalent.

2.3 DELIVERY, STORAGE, AND HANDLING

A. Prior to ordering and delivery of equipment, the Contractor shall:

1. Verify that the equipment shall adequately pass through building openings and passageways with unobstructed access to the final equipment location. When building openings and passageways will not permit the equipment to pass through unobstructed, equipment shall be manufactured and shipped in sections for final assembly at the equipment location.

2. Verify that the equipment shall properly fit the space allocated, that required clearances can be maintained, and that the equipment can be located without interference from other systems, structural elements, or the work of other trades.
B. The Contractor shall arrange deliveries in accordance with the construction schedule. Deliveries shall be scheduled to maintain the progress of work, to avoid conflict with the work of other Trades, and to accommodate site conditions.

1. The Contractor shall be responsible for coordinating and scheduling the timely delivery of products and materials indicated to be furnished by others or by the Owner.

C. Deliver, store and handle products and materials in full compliance with the manufacturer’s recommendations and/or instructions, using means and methods that will prevent damage, deterioration, and loss (including theft).

D. The Contractor shall protect products and materials until Final Acceptance. Such protection is the sole responsibility of the Contractor, and the Contractor shall be responsible for replacing damaged, deteriorated, stolen or lost product at no additional cost to the Owner.

1. Where products and materials are indicated to be furnished by others or by the Owner, the Contractor shall make a complete and careful check of all materials delivered. The Contractor shall provide a written and signed receipt acknowledging acceptance of the delivery and the condition of the materials delivered. After receipt, the Contractor shall assume full responsibility for the materials.

E. Products and materials subject to damage by the elements shall be stored above ground, under cover, in a weather tight enclosure, with ventilation adequate to prevent condensation. Temperature and humidity shall be maintained within the manufacturer’s recommendations.

F. The Contractor shall make provisions for receiving and storing products and materials, including products and materials to be furnished by the Owner (or by others) to be installed by the Contractor as part of the work.

G. Products and materials shall be carefully inspected for damage upon delivery. Defective or damaged products and materials shall be marked ‘Rejected’, removed from the site, and shall not be installed.

H. Products and materials shall be delivered to the site in the manufacturer’s original containers, complete with labels and instructions for the proper handling, storage, unpacking, protection and installation.

I. The Contractor shall ensure that products and materials to be installed are not temporarily used as steps, ladders, platforms, scaffolds, or for storage by the Contractor or by other trades during the construction process. Materials found to be used in such a manner will be considered “damaged”, shall not be installed, and shall be replaced at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the latest edition of applicable portions of the Governing Requirements in effect at the time of construction, including all addenda, errata, annexes, and technical service bulletins (TSBs), etc., except where a specific edition is otherwise indicated, or where otherwise mandated by a Governing Authority. Where the specific edition is indicated for a Governing Requirement that is not mandated by a Governing Authority, and a later edition is available for such Governing Requirement at the time of construction, the more stringent applicable provisions of both the latest and specifically indicated editions of such Governing Requirement shall prevail.

B. In the event of a conflict between a code and the other Governing Requirements, or between a code and a requirement of the Construction Documents, the code requirement shall govern. However, if the non-
code requirement (or portion thereof) exceeds that of the code, and is furthermore not contrary to the code, the non-code requirement (or portion thereof) shall prevail.

C. Installation shall be performed by workers skilled in the trade, familiar with the particular techniques and methods of construction applicable to the work of the trade.

D. Completed work shall present a neat and professionally installed appearance. The appearance of the work shall be of equal importance to its operation. Failure to present a neat and professionally installed appearance shall be considered sufficient reason for rejection of the system in part or in whole.

E. Completed work shall demonstrate quality workmanship. Quality workmanship shall be of equal importance to its operation. Failure to demonstrate quality workmanship shall be considered sufficient reason for rejection of the system in part or in whole.

F. In the event that supplemental information is required to confirm the intent of the Construction Documents, the Contractor shall notify the Engineer and await the Engineer’s response prior to procurement of materials and performance of the related work. Procurement of materials and work performed without such interpretation and/or clarification is at the sole risk of the Contractor, and as such, the Contractor shall correct such work at no additional cost to the Owner should the materials or work not conform to the intent of the Construction Documents.

G. The Contractor shall order and install materials and equipment with long lead times and/or those having a major impact on work by other trades so as not to jeopardize the project or project schedule.

H. The Contractor is responsible for ensuring that each installed component’s performance is within the Manufacturer’s published specifications, the Governing Requirements, and all other requirements as specified within this Division.

I. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances, and Governing Requirements, including but not limited to employee training and Safety Program development, documentation and execution.

J. Notwithstanding any other provisions of the Contract Documents, the Contractor shall be solely responsible for location and protecting any and all utility service lines (both Owner controlled and Public) in the work area.

3.2 IDENTIFICATION

A. All Contractor personnel shall be clearly identified by uniform and/or company badge with photo ID, employee’s name, and company name. Contractor vehicles shall be equipped with signs on both sides of vehicle identifying the Contractor’s company name.

3.3 SUPERVISION

A. The Contractor shall appoint a Project Manager who will be the single point of contact for all work accomplished under this Project and will be vested by the Contractor with the authority to make decisions on behalf of the Contractor.

1. The Project Manager will be responsible to represent the Contractor and coordinate all aspects of this Project, including but not limited to:

   a. Overall and specific project responsibility

   b. Thorough knowledge of Project Specifications and Drawings
c. Creation and maintenance of a project schedule, including milestones, task definitions and resource allocations

d. Attendance at all Project Management meetings

e. Supervision and direction of all Contractor personnel

f. Documentation, including submittals and change orders

g. Quality assurance of Project

2. The Project Manager initially assigned to the Project shall be assigned to the Project for the duration of the Project. Once assigned by the Contractor, the Project Manager shall not be changed by the Contractor without Engineer and Owner approval.

B. The Contractor shall assign a qualified Foreman to the Project and shall keep the Foreman on site and in charge of the work at all times. The Foreman shall be equipped with a mobile phone during project working hours.

1. The Foreman initially assigned to the Project shall be assigned to the Project for the duration of the Project. Once assigned by the Contractor, the Foreman shall not be changed by the Contractor without Engineer and Owner approval.

3.4 PERMITS AND FEES

A. The Contractor shall make arrangements to obtain and pay for necessary permits, licenses, and inspections.

B. No work shall be started prior to obtaining necessary permits and payment of required fees. Work installed prior to obtaining proper permits shall, if required by the Governing Authority (AHJ), be redone in compliance with requirements at no additional cost to the Owner.

3.5 INSTALLATION

A. The Contractor shall notify the Engineer and wait for direction/instruction prior to proceeding with procurement and installation for any portion of the Work which could be affected by the following:

1. Required items and/or details have been omitted from the Construction Documents.

2. Discrepancies or conflicts exist between the requirements of the Drawings and the Specifications, between the Governing Requirements and the Construction Documents, and/or between the various Governing Requirements.

3. Discrepancies or conflicts between the requirements of this Division and those of Division 1.

B. Dimensions and clearances:

1. Equipment dimensions and dimensions indicated for the installation of equipment are restrictive dimensions. Verify that the equipment will fit within the indicated locations and spaces.

2. Maintain, at a minimum, code required clearances.

3. Promptly notify the Engineer of any potential dimension or clearance conflicts, and await the Engineer’s direction prior to purchase and rough-in of the equipment.
C. Access:

1. Install equipment such that it is readily accessible for operation and maintenance.

2. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.

3. Do not install equipment such that it interferes with the normal operation or maintenance requirements of other equipment.

D. Equipment shall be installed level, plumb, parallel, and perpendicular to building structures and to other building systems and components, except where otherwise indicated.

E. Seismic Bracing: Equipment shall be seismically braced as required by the governing requirements. Bracing shall be rigid – non-rigid bracing (chains, cables, etc.) is not acceptable, unless otherwise recommended by the manufacturer and approved or specified by the governing requirements. Seismic bracing hardware shall be provided by the manufacturer, or shall be approved or recommended by the manufacturer. Where no manufacturer hardware, approval, or recommendation is available, the seismic assembly shall be approved by a licensed structural engineer.

F. Equipment shall be securely fastened. Select fasteners so that the load applied to any one fastener does not exceed 25 percent of the proof-test load.

G. Place equipment labels and/or other identification where the label and/or identification can be easily seen and read without difficulty.

H. Grounding/Bonding: Bond all non-current carrying raceway to the nearest TGB.

I. Attachment of hanger rods, support cables, diagonal wall bracing, and any other connections made to the building structure after the application of fireproofing/firestopping materials, shall be made with minimal impact to the fireproofing/firestopping materials. The Contractor making such connections shall remove only as much fireproofing/firestopping as required for the attachment, and for scoring and over-cut only as required for the connection. The Contractor shall be held responsible for costs associated with patching of excessively removed fireproofing/firestopping material.

J. Cables, conduits, and other raceway shall be firmly secured and cleaned where penetrating fire rated barriers.

3.6 DRAWINGS

A. Drawings shall not be scaled for rough-in measurements or equipment locations. Field verification of dimensions, locations, and levels to suit field conditions is required. Final placement of devices, outlets, equipment, etc. shall be coordinated with field conditions.

B. Unless specifically dimensioned or detailed, Drawings indicate approximate locations, arrangement, and general character. To avoid interference with structural members and equipment of other trades, or for the convenience of the Owner, it may be necessary to adjust the locations shown on the Drawings prior to installation. Unless specifically dimensioned or detailed, and with the exception of locations of equipment and raceway in specialized communications rooms and spaces (such as Telecommunications Rooms, Data Centers, etc.), the Contractor may make minor location adjustments without obtaining the Engineer’s prior approval. All other adjustments require prior approval from the Engineer.

1. Minor adjustments are defined as distances not to exceed:
a.  1 foot at grade, floor ceiling, and roof level in any direction in the horizontal plane
b.  1 foot on walls in a horizontal direction within the vertical plane.

2.  Particular attention shall be paid to door swings, piping, ductwork, structural steel, and other ceiling conflicts:
   a.  In general, waste and vent lines, large pipe mains, and ductwork shall be given priority for the locations and spaces shown.
   b.  In general, electrical lighting fixtures shall be given priority for ceiling space.

3.  Where minor location adjustments are required, such adjustments shall be made at no additional cost to the Owner.

3.7 RESTORATION
   A.  The Contractor shall restore all floors, ceilings, walls, furniture, grounds, pavement, etc. affected or damaged by the Contractor’s work. All such areas shall be restored to original condition at no additional cost to the Owner.
   B.  The Contractor shall restore to original finish all new products, materials, and equipment scratched, chipped, or otherwise marred by the Contractor.
   C.  Restoration in every instance consists of completing the work to match and blend with the adjoining existing work insofar as methods, materials, colors, and workmanship are concerned.
   D.  Restoration work shall be performed by workers qualified and skilled in the trades involved.
   E.  Where restoration work requires painting: Painting shall consist of cleaning, surface preparation, painting (primer, intermediate, and finish) and finishing surfaces, for items both new and existing, affected by the work of the Contractor. Surface painting shall match and blend with existing adjoining surfaces. The areas around penetrations, once sealed, shall be painted.
   F.  The Contractor shall be responsible for replacing improperly matched, blended, or poorly constructed restorative work at no additional cost to the Owner.

3.8 HOUSEKEEPING
   A.  During the course of construction:
      1.  The Contractor shall keep the building, premises and surrounding area free from accumulated surplus, waste materials and rubbish at all times.
      2.  At the conclusion of each work shift, remove empty boxes, crates, surplus and waste materials, and other debris, and sweep clean all work areas affected by the Contractor’s work.
      3.  In occupied areas affected by the Contractor’s work, the Contractor shall remove all evidence of the Contractor’s work in those areas at the end of each work shift, including tools, equipment and scaffolding, leaving the area clean, unobstructed and fully useable by the occupants.
   B.  At project completion, and prior to Final Acceptance:
      1.  Remove all tools, equipment and scaffolding.
2. Remove temporary labels and adhesives.

3. Thoroughly vacuum the interior of enclosures to remove debris.

4. Clear surplus product, materials and debris from the job site.

5. Turn over equipment to the Owner in unblemished condition.

6. Thoroughly clean equipment and facilities inside and out, and remove all residue -- all areas affected by the Work shall cleaned.

7. Turn over the Work to the Owner in a fully operational state.

C. All final cleanup work shall be performed by professional cleaners qualified and skilled in the trade. The Contractor shall not make use of unqualified personnel for cleanup work.

D. The Project shall not be considered complete until all area affected by the Work are left in a clean, neat, orderly, and fully operable condition.

3.9 SUBSTANTIAL COMPLETION

A. Due to the technical nature of the Work, as well as the requirement that certain Owner provided equipment, systems, and training may necessitate use of the Work by the Owner prior to Substantial Completion, the Owner reserves the right to use the Work prior to Substantial Completion (when ready for use) without obligation to the Contractor and without implying Acceptance of the Work.

B. Pre-Substantial Completion Submittal: Three weeks prior to Substantial Completion, the Contractor shall prepare and submit the following:

1. Known Exceptions/Deviations List:
   a. The Contractor shall compile a thorough list of known exceptions/deviations (in materials, construction, and/or workmanship) from that specified in the Contract Documents, and for which there was not associated documentation in the form of Change Orders (CO), Construction Change Directives (CCD), Architects Supplemental Instructions (ASI), or responses to a Request for Information (RFI).

   b. The Contractor shall submit the list to the Engineer for review. The Engineer shall review each item and mark as either Accepted or Not Approved.

      1) Items marked “Not Approved” shall be corrected by the Contractor to conform with the intent of the Contract Documents at no additional cost to the Owner.

      2) The Contractor shall perform corrective action for “Not Approved” items prior to notifying the Engineer that the work is Substantially Complete.

2. Other information as called for in the individual Specification Sections.

3. Owner Specific: Submit other information as required by Owner Specific Governing Requirements.

C. Notice of Substantial Completion: When the Work nears Substantial Completion, the Contractor shall notify the Engineer in writing the date that the work will be Substantially Complete and ready for review by the Engineer.
3.10 PROJECT CLOSE-OUT

A. Punchlist:

1. Once notice of Substantial Completion is received, the Engineer shall visit the site to review the Work, and shall prepare a punchlist of items determined to be incomplete, deficient or otherwise not in compliance with the intent of the Contract Documents.

   a. During the review of the Work, if the Engineer finds that the Known Exceptions/Deviations List provided by the Contractor was insufficiently thorough, that the Work is not Substantially Complete, or that deficiencies in the work are excessive, the Engineer will cease review and inform the Contractor that the work is not Substantially Complete. The Contractor shall be responsible for fees incurred by the Engineer for this partial review.

2. The Contractor shall perform corrective action for each item noted in the punchlist. When complete, the Contractor shall submit the original punchlist with each item initialed attesting to the fact that the item was corrected.

   a. If necessary, the Engineer will perform a subsequent review after receipt of the Contractor initialed punchlist.

3. Should additional reviews beyond the original punchlist review be required of the Engineer due to the Contractor’s failure to correct all incomplete, deficient, or non-compliant work, the Contractor shall be responsible for fees incurred by the Engineer for the additional reviews.

B. Acceptance Testing

1. Once the punch list items have been corrected, the Engineer shall visit the site to review the fully functioning and operating system and shall prepare an acceptance testing punchlist of items determined to be incomplete, deficient or otherwise not in compliance with the intent of the Contract Documents.

   a. During the review, the Engineer finds that the Known Exceptions/Deviations List provided by the Contractor was insufficiently thorough, that the Work is not Substantially Complete, or that deficiencies in the work are excessive, the Engineer will cease review and inform the Contractor that the work is not Substantially Complete. The Contractor shall be responsible for fees incurred by the Engineer for this partial review.

2. The Contractor shall perform corrective action for each item noted in the acceptance testing punchlist. When complete, the Contractor shall submit the original acceptance testing punchlist with each item initialed attesting to the fact that the item was corrected.

   a. If necessary, the Engineer will perform a subsequent review after receipt of the Contractor initialed acceptance testing punchlist.

3. Should additional reviews beyond the original acceptance testing punchlist review be required of the Engineer due to the Contractor’s failure to correct all incomplete, deficient, or non-compliant work, the Contractor shall be responsible for fees incurred by the Engineer for the additional reviews.
C. Provide O&M Manuals per the requirements of Part I – General: Operating & Maintenance (O&M) Manuals herein.

END OF SECTION 27 00 10
SECTION 27 00 20

CONTRACTOR QUALIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines Contractor qualifications and requirements for bidding the various systems in this Division.

1.2 QUALIFICATIONS FOR BIDDING

A. Contractors shall be qualified to bid per the requirements of Part 1 – General: Contractor Qualifications herein. Qualification criteria shall be satisfied prior to the date of Bid.

B. Pre-qualified/Pre-approved Contractors:

1. The following Contractors have met the qualification requirements and are pre-approved (by system type) to bid the Work (listed in alphabetical order):

   a. Communications Cabling System:

      1) Americom
      a) Bill Deane, 303-789-9574, BDeane@americomonline.net

      2) Linx
      a) Troy Brumley, 303-307-3622, Troy@TeamLINX.com

      3) National Network Services
      a) John Fitzgerald, (720) 264-1062, john.fitzgerald@nnsi.net

   b. AudioVisual Systems

      1) CCS Presentation Systems (Lenny Marko-Franks, 303-694-3323)

      2) Ford AV (Daniel Routman, 720-374-2345)

      3) Linx (Mark Merrick, 303-307-3630)

      4) Xcite AV (Brian Seid, 720-771-1011)

   c. Electrical

      1) Refer to Division 26 for Electrical Contractor requirements.

C. Contractors not listed above as Pre-qualified/Pre-approved must be qualified to bid per the requirements of Part 1 – General: Contractor Qualifications herein and shall submit their Statement of Qualifications (see Part 1 – General, Statement of Qualifications herein) with their bid for owner review. Bids which are submitted without a Statement of Qualifications or bids submitted with a Statement of Qualifications that is incomplete or does not clearly demonstrate that the qualification requirements have been met shall be rejected.
1.3 CONTRACTOR QUALIFICATIONS

A. General

1. Experience:
   a. Governing Requirements: The Contractor shall have demonstrated, in-depth and working knowledge of the applicable portions of the Governing Requirements as noted in Division 27 Specification Section Basic Communications Requirements and as they pertain to the systems to be installed by the Contractor. The Contractor shall provide a signed statement stating same.
   b. Design and Installation Practices: The Contractor shall have demonstrated, in-depth and working knowledge of the generally accepted design and installation practices for the systems to be installed by the Contractor. The Contractor shall provide a signed statement stating same.
   c. Contractor References:
      1) Project: The Contractor shall provide references for no less than five similar projects (in terms of size and construction cost) performed by the Contractor within the past three years.
         a) The reference list shall detail, for each project:
            1. Project name and location
            2. Construction cost
            3. A brief description of the project and the components involved
            4. Contact names, phone numbers, and addresses
            5. Date completed
      b) A minimum of two of the references shall be in the vicinity of the Project and shall be available for the Owner and Engineer to visit and inspect the installation. The Contractor shall highlight or otherwise make note of these particular references.
      2) Service Department: The Contractor shall provide a minimum of two references for the Contractor’s Service Department. A minimum of one of the references shall be in the vicinity of the Project.

2. Manufacturer(s) Certification:
   a. The Contractor shall be trained and certified by the Manufacturer(s) to install, test, and maintain the major components of the system, shall be certified to perform service and equipment modifications without voiding the Manufacturer(s) warranty, and shall be certified by the Manufacturer(s) to provide these services in the location in which the Work is to be performed. The Contractor shall provide evidence of same for each major component Manufacturer – statements on letterheads from distributor, importer or local sales representatives are not be acceptable.

3. Offices:
   a. Locations: Provide locations of all regularly/fully staffed and operational offices and the number of administrative staff and technical personnel in each. Indicate which office(s)
have a Service Department, and of those offices, indicate the number and type of personnel staffing the Service Department.

b. Service Department: The Contractor shall maintain a permanently staffed and equipped Service Department, regularly providing services for the systems to be installed by the Contractor. The Contractor shall provide a signed statement stating same.

c. The Contractor shall be licensed, bonded, and insured in the State in which the Work is to be performed. The Contractor shall provide evidence of same.

d. If required by the locality, the Contractor shall be licensed by the locality. The Contractor shall provide evidence of same.

4. Personnel:

a. Project Manager: The Contractor’s Project Manager assigned to this project shall have a minimum of three years continuous contracting project management experience on projects of similar size and complexity. The Project Manager shall have the authority to act for the Contractor, shall serve as the technical liaison between the Contractor and the Engineer, shall represent the Contractor at all meetings, shall be responsible for supervision of all work required to execute the Contract, shall review and approve all submittals prior to submission, and shall be present at the job site during final inspection. The Contractor shall provide a resume for the Project Manager which shall include:

1) A summary of the Project Manager’s experience, including education, with emphasis on key skills relating to project management and the technical aspects of the systems for which the Project Manager will have responsibility.

2) A listing of continuous projects (with dates) over the past three years on which the Project Manager performed project management duties. Project information shall include:
   a) Project name and location
   b) Construction cost
   c) A brief description of the project and the components involved
   d) Contact names, phone numbers, and addresses
   e) Date completed

b. Foreman: The Contractor’s Foreman assigned to this project shall have a minimum of three years continuous supervision experience on projects of similar size and complexity. The Contractor shall provide a resume for the Foreman which shall include:

1) A summary of the Foreman’s experience, including education, with emphasis on key skills relating to installation supervision and the technical aspects of the systems for which the Project Foreman will have responsibility.

2) A listing of continuous projects (with dates) over the past three years on which the Foreman performed supervisory duties. Project information shall include:
   a) Project name and location
   b) Construction cost
   c) A brief description of the project and the components involved
   d) Contact names, phone numbers, and addresses
c. Employee Certification: Contractor personnel directly involved with the supervision, installation, testing, and certification of the system shall be trained and certified by the major component Manufacturer(s). The Contractor shall provide evidence of same.

B. Communications Systems Specific Qualifications: Additional Contractor Qualifications are required for each system as follows:

1. Communications Cabling System

   a. The Contractor shall be completely familiar with and have extensive working knowledge of the TIA/EIA standards for telecommunications systems, the design and installation practices as defined in the BICSI Telecommunications Distribution Methods Manual, and the installation practices as defined in the BICSI Telecommunications Cabling Installation Manual. The Contractor shall provide a signed statement stating same.

   b. RCDD: The Contractor shall assign an RCDD (Registered Communications Distribution Designer) to the project. The RCDD shall be a permanent member of the Contractor’s staff (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable) and shall be in current good standing with BICSI. The Contractor shall provide the name of and evidence of certification for the Contractor’s RCDD to be assigned to the project.

   c. Manufacturer Certification: The Contractor shall be trained and certified by the specified communications cabling system Manufacturer to install, test, and maintain the communications cabling system, shall be certified by the Manufacturer to provide the Manufacturer’s most comprehensive performance and product warranty per the requirements of Division 27 Specification Section Warranty and its related sub-sections, and shall be certified by the Manufacturer to provide this warranty in the location in which the work is to be performed. The Contractor shall provide evidence of same.

      1) The Contractor shall be Manufacturer Certified as one or more of the following:

         a) Copper:

            1. Berk-Tek/Ortronics

               (i) The Telecommunications contractor must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-GOLD, CIP-PLATINUM, and multi-site/national contractors) and/or Berk-Tek Certified OASIS Integrator. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CI/CIP Program and Berk-Tek OASIS Program. At least 30 percent of the copper installation and termination crew must be certified by BICSI, Berk-Tek, or Ortronics with a Technicians Level of Training. Also, at least 10 percent of the optical fiber installation and termination crew must be certified by Berk-Tek or Ortronics or other approved organizations in Optical Fiber installation and termination practices.

         d. Employee Certification: Contractor personnel shall be trained and certified by the Manufacturer as follows. The Contractor shall provide evidence of same:
1) Project Foreman and Supervisors: All (100 percent) shall be trained/certified by the Manufacturer for design, installation and testing.

2) Technicians (responsible for testing, termination, connectorization, and determination of pathway/routing, and technical labor): All (100 percent) shall be trained/certified by the Manufacturer for installation and testing.

3) Installers (responsible for cable installation, non-technical labor, etc.): Not required (subject to the requirements of the Manufacturer’s warranty and that of the next paragraph). However, these technicians must be directly supervised by a certified Installation Technician in an on site ratio of not less than one Manufacturer certified Installation Technician per two non-certified installers.

4) Overall, at least 30 percent of installation personnel shall be BICSI Registered Telecommunications Installers or have an equivalent Manufacturer’s certification. Of that number, at least 15 percent shall be registered at the Technician’s Level, at least 40 percent shall be registered at the Installer Level 2, and the balance shall be registered at the Installer Level 1.

5) Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the communications cabling system (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer trained and certified.

2. AudioVisual Systems
   a. Programmer Certification: The Contractor shall have Manufacturer certified programmers for all equipment requiring programming. The Contractor shall provide evidence of same.
   b. In-House Capabilities: The Contractor shall have in-house capabilities and facilities for rack assembly, shop fabrication, and programming. The Contractor shall provide a signed statement stating same.
   c. Product Dealer Information: Provide a list of manufacturers/products for which the Contractor is a Dealer. Provide the duration of the relationship and the extent of manufacturer/product training.

3. Electrical For Communications Systems
   a. Refer to Division 26 for Electrical Contractor requirements.

1.4 STATEMENT OF QUALIFICATIONS (SOQ)
   A. The Contractor shall prepare a Statement of Qualifications which shall include all documentation verifying compliance with the requirements of and as called for in Part I – General: Contractor Qualifications herein. The Statement of Qualifications shall include, at a minimum:

   1. General:
      a. Governing Requirements Statement
      b. Design and Installation Practices Statement
      c. Contractor Project References
      d. Contractor Service Department References
e. Evidence of Manufacturer(s) Certification

f. Office locations and information

g. Service Department Statement

h. Evidence of licensing, bonding, and insurance

i. Project Manager Resume

j. Foreman Resume

k. Evidence of Manufacturer(s) Training/Certification for those personnel for which training/certification is required.

2. Communications Systems Specific Statement of Qualifications: There are additional SOQ requirements for each system. The Contractor shall include the following system specific documentation within the Statement of Qualifications specified above:

a. Communications Cabling System
   1) TIA/EIA Standards and BICSI Practices Statement
   2) Evidence of certification for the Contractor’s RCDD assigned to the project
   3) Evidence of Manufacturer(s) Certification and Warranty
   4) A list of personnel to be assigned to the project, the type of work they will be performing, and evidence of Manufacturer(s) Training/Certification for those personnel for which training/certification is required.

b. AudioVisual Systems
   1) Evidence of Programmer Certification
   2) In-house Capability Statement
   3) Product Dealer Information

c. Electrical For Communications Systems
   1) No additional information is required.

B. A Statement of Qualifications that is incomplete or does not clearly demonstrate that the qualification requirements have been met shall be rejected

1.5 SUBMITTALS

A. All Communications Systems contractors, even if listed as Pre-qualified/Pre-approved above, shall provide the following per the criteria set forth in Submittals in Division 27 Specification Section Basic Communications Requirements:

   1. Other Information:

      a. Provide a Statement of Qualifications for each Contractor and for each system to be provided by the Contractor.

PART 2 - MATERIALS (NOT USED)
PART 3 - EXECUTION (NOT USED)

END OF SECTION 27 00 20
SECTION 27 00 30

BIDDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides requirements for bidding, including a format and definitions for the presentation of pricing for the base bid, and where applicable, alternate bid(s) and unit pricing. The contents of this Section are intended to establish pricing breakdowns which are useful to the Owner and the Engineer for evaluating bid responses.

B. Information as called for in this Section shall be provided per the requirements of the General Provisions of the Contract, Bidding Documents, Contract Forms, General Conditions, and the Construction Documents.

1.2 BASIS OF BID

A. The Contractor shall determine all existing conditions affecting the work, the type of construction to be used, and the nature and extent of work provided by other trades. Failure to do so shall be construed as willingness to provide complete and fully operational system(s) within the amount bid by the Contractor.

B. The Contractor shall notify the Engineer a minimum of ten (10) days prior to the bid date in the event of any of the following circumstances:

1. Required items or details have been omitted from the Construction Documents

2. Discrepancies or conflicts between the requirements of the Drawings and the Specifications, between the Governing Requirements and the Construction Documents, and between the various Governing Requirements.

3. Discrepancies or conflicts between the requirements of this Division (27) and those of Division 0 or Division 1.

C. Where omissions, discrepancies, or conflicts are not brought to the attention of the Engineer, it shall be assumed that the most stringent requirement(s) constitute the basis for the Contractor’s bid, and as such shall be construed as willingness by the Contractor to provide complete and fully operational system(s) within the amount bid.

D. Fees for necessary or required licenses, permits, and inspections shall be included in the bid amount.

E. Bids shall be based on products, materials and methods of construction as specified. Bids based upon substitution of product and materials, as well as deviations from the methods of construction specified, shall be at the sole risk of the Contractor and as such are subject to rejection without consideration at the time of submittal review – should the Contractor be awarded the contract.

F. If the bidder proposes to sub-contract portions of the work, sub-contractors shall be identified and their Statement of Qualifications (per Division 27 Specification Section Contractor Qualifications) submitted as part of the Bidder’s bid submission.

1. The Contractor is responsible for any and all work performed by a sub-contractor, and shall provide direct and continuous supervision of the sub-contracted work. Furthermore, this clause
applies to any work provided by the Manufacturer(s) for equipment installation at the Contractor’s request.

G. By submitting a Bid, the Contractor agrees:

1. To honor the Contractor’s Bid for 90 days subsequent to the date that bids are opened.

2. To enter into and execute a Contract, if awarded, and to furnish all bonds and insurance required by the Contract Documents.

3. To accomplish the Work in accordance with the Contract Documents.

4. To complete the Work within the schedule stipulated by the Contract.

1.3 BID FORMAT

A. The Bid shall contain the following mandatory documentation. Bids submitted without this documentation (in whole or in part) may be rejected without review. The documentation shall be provided in addition to any forms/documents required by the General Provisions of the Contract and/or the contracting authority.

1. Statement of Qualifications: Provide per Division 27 Specification Section Contractor Qualifications and/or its sub-sections.

2. Bid Form: A bid form summarizing the Contractor’s bid as required by the General Provisions of the Contract and/or the Contracting Authority.

3. Bid Supplement: Complete the Bid Supplement attached to the end of this Section.

   a. The Bid Supplement shall be completed in addition to any forms/documentation required by the General Provisions of the Contract and/or the contracting authority.

4. Additional Information:

   a. Subcontractor Identification: Identify sub-contractors and their responsibilities. Submit their Statement of Qualifications per Division 27 Specification Section Contractor Qualifications and its sub-sections.

   b. Bill of Materials (BOM): The BOM shall include each item individually priced, and shall reflect any and all required modifications, accessories, and labor for the item. Each item listed shall be complete with the following information:

      1) Description
      2) Part number (if applicable)
      3) Quantity included in bid
      4) Material cost (including all required modifications, accessories and incidental materials)
      5) Labor cost to install (if applicable)
      6) Total installed price

1.4 BID SUBMITTAL
A. Bids shall be submitted in the form required by the Division 1 specifications.

1.5 ALTERNATE PRICING

A. An Alternate is an amount proposed by the Contractor and stated on the Bid Form for certain work defined in the Construction Documents that may be added to or deducted from the Base Bid amount.

1. The cost or credit for an alternate is the net addition to or deduction from the Base Bid to incorporate the alternate into the work.
2. Alternate pricing shall include all costs of related coordination, modification, or adjustment of the work to accommodate and completely integrate the Alternate into the project, and shall include all necessary materials, labor, delivery, insurance, applicable taxes, overhead, markups and profit.

B. Provide alternate pricing for the addition/deduction of the work specified below. Alternates are broken out by the system(s) to which they pertain:

1. Audiovisual: Addition of program speakers and audio amplifier as indicated on floor plans, equipment schedule, and one-line diagram. Reference Architectural documents for information regarding alternate numbering and additional requirements.

1.6 UNIT PRICING

A. Unit pricing is a price per unit of measurement for materials, equipment and/or labor added to or deducted from the Contract Sum by appropriate modification. Unit pricing is to be provided for common items which may be added or deleted during the course of construction.

1. It is the intent that components added by unit price during construction shall result in complete and operable components ready for the Owner’s use. It is further the intent that components deducted by unit pricing shall not adversely impact the remaining or adjacent work.

2. Unit prices shall include all costs of related coordination, modification, or adjustment of the Work to accommodate and completely integrate the component into the project, and shall include, but shall not be limited to, all necessary materials, labor, programming, incidentals, delivery, insurance, applicable taxes, overhead, markups and profit.

3. Unit pricing shall remain in effect until Final Acceptance.

B. Provide unit prices for the addition/deduction of the items specified below. Unit pricing is broken out by the system(s) to which they pertain.

1. Communications Cabling System:

   a. Horizontal Copper Outlet: Cable, faceplate, connectors (station and patch panel), terminations, incidental materials, testing, labeling, etc. for any location (regardless of distance from the Telecommunications Room). Provide pricing by outlet type and port quantities as follows:

      1) 1-port
      2) 2-port

2. Electrical:
a. Outlet Box Raceway: One recessed 4-11/16” inch by 4-11/16 inch deep outlet box with single gang mudring at the horizontal outlet location with conduit raceway from the outlet box location to:

1) Telecommunications Room
2) Accessible Ceiling

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 27 00 30
SECTION 27 00 40

WARRANTY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines general warranty requirements for the Communications System(s).

1.2 GENERAL

A. Warranty

1. The Contractor shall warrant the Work against all defects in materials, equipment and workmanship in compliance with the applicable requirements of Division 1.

2. Manufacturer Warranties: The Contractor’s Warranty shall include all Manufacturer Warranties. The Contractor shall represent and act on the Owner’s behalf in any and all Manufacturer warranty/replacement proceedings.

3. Manufacturer Support Contract(s): The Contractor shall provide any manufacturer backed maintenance, warranty and/or technical support contract necessary for the Contractor to configure, operate, service, repair and/or replace any component of the Communication System(s). The contract shall be valid for the duration of the warranty period. The Contractor shall purchase the contract in the Owner’s name and provide documentation and renewal information to the Owner at acceptance testing.

4. The Contractor shall comply with the Submittal portions of Division 27 Specification Section Basic Communications Requirements.

5. All labor, materials, equipment, and other costs and services necessary for the fulfillment of the Warranty shall be provided at no charge to the Owner.

B. Warranty Period

1. Unless otherwise noted, the minimum Warranty Period shall be 1 year or as otherwise called for in the Division 1 specifications.

2. The Warranty Period shall commence upon Final Acceptance.

3. Manufacturer Warranties:

   a. The Contractor shall honor Manufacturer Warranties for the full term established by the Manufacturer when said term is greater than the Warranty Period.

   b. In cases where Manufacturer Warranties are less than the Warranty Period, the Contractor is liable for and shall warrant the Manufacturer’s equipment for the entire term of the Warranty Period.

   c. Where the Contractor has modified equipment, the Manufacturer’s warranty may be voided. In such cases, the Contractor shall warrant the Manufacturer’s equipment for a
term equivalent to that of the original Manufacturer Warranty term, or for the entire Warranty Period, whichever is greater.

C. Warranty Certificate

1. The Contractor shall provide a written Warranty Certificate on the Contractor’s letterhead, signed by the Contractor, with terms and conditions of the Warranty complying with the requirements detailed herein.

2. The Warranty Certificate shall include copies of all Manufacturer Warranties. Manufacturer Warranties shall be activated by the Contractor in the Owner’s name.

3. The Warranty Certificate shall be submitted as part of the O&M Manual submission.

D. Warranty Fulfillment

1. The Contractor shall provide a Warranty service visit within 24 hours of notification.

2. Defects shall be remedied within 72 hours of notification.

1.3 SYSTEM SPECIFIC

A. The Contractor shall include the following additional Communications System specific items as part of the Warranty above:

1. Communications Cabling System:

   a. Communications Cabling System Manufacturer Warranty: The Contractor shall provide a communications cabling system extended product, performance/application, and labor Manufacturer Warranty that shall warrant all passive components used in the communications cabling system. Additionally, this Warranty shall cover all components not manufactured by the Manufacturer, but approved by the Manufacturer for use in the communications cabling system (i.e. “Manufacturer Approved Alternative Products”).

      1) The Manufacturer Warranty shall warrant:

         a) That the products will be free from manufacturing defects in materials and workmanship.

         b) That all cabling products of the installed system shall exceed the specification of TIA/EIA 568 performance standards. For copper based cabling products, the TIA/EIA 568 Category rating of the specified system shall be exceeded.

         c) That the installation shall exceed TIA/EIA 568 installation standards.

         d) That the system shall be application independent and shall support both current and future applications that use the TIA/EIA 568 component and link/channel specifications for cabling.

         e) That all labor and materials and other costs attributable to the fulfillment of the Manufacturer Warranty shall be provided at no additional cost to the Owner.

      2) The Manufacturer Warranty shall be:

         a) Copper:
   (i) Berk-Tek/Ortronics will extend a NetClear 25-year Static, Dynamic and Applications Warranty to the end user once the Telecommunications contractor fulfills all requirements under Ortronics CI/CIP and/or Berk-Tek OASIS Program.

b) Fiber:
   1. Corning Cable Systems LANscape Solutions Extended Warranty Program (EWP).

3) Manufacturer Warranty Period:
   a) The Manufacturer Warranty Period shall commence upon Final Acceptance or a Warranty Certificate being issued by the Manufacturer, whichever is later.

4) Manufacturer Warranty Certificate:
   a) The Manufacturer Warranty Certificate shall be included with the Contractor Warranty.

2. AudioVisual Systems
   a. Replacement: Defective components which cannot be serviced within five business days due to unavailability of parts or services shall be replaced with new, identical components. If new and identical components are not available, the Contractor may provide new and equal substitutes upon Owner approval. Replaced components shall become the property of the Owner, and shall be warranted by the Contractor for the remaining term of the Warranty Period, or the term of Manufacturer’s Warranty, whichever is longer.

   b. Preventative Maintenance: The Contractor’s Warranty shall include 2 preventative maintenance visits during the Warranty Period for the purposes of verifying equipment operation, cleaning and lubrication, minor modifications to programming, adjustment and alignment of equipment, and other services as necessary and as requested by the Owner.

      1) The Contractor shall submit a written summary of the maintenance work performed during each Preventative Maintenance visit within five business days of the visit.

3. Electrical For Communications Systems
   a. No additional warranty items required.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 27 00 40
SECTION 27 00 50
QUALITY ASSURANCE

PART 1 - GENERAL

1.1 SUMMARY
A. This Section defines processes and procedures for quality assurance applicable to Division 27.

1.2 GENERAL QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)
A. Design Intent Meeting
   1. The Contractor shall schedule and attend a meeting to review the design with the Engineer, Owner, and the General Contractor. The purpose of the meeting will be to ensure that the Contractor fully understands the design intent as detailed in the Contract Documents. The Contractor shall thoroughly review the Contract Documents prior to the meeting, and shall document questions, comments, and/or concerns to be discussed at the meeting. The meeting shall take place prior to Submittal preparation and submission. Attendees shall include:
      a. Communications System Contractor(s)
         1) Communications Cabling System
         2) AudioVisual Systems
         3) Others as applicable
      b. Electrical Contractor
      c. General Contractor
      d. Engineer
      e. Owner

B. Pre-installation Meeting
   1. Prior to beginning work in a given area (or areas), the Contractor shall schedule and attend a pre-installation meeting to review and coordinate work within that area with the other trades. The purpose of the meeting will be to review the communications pathway/raceway layout and identify and resolve any potential conflicts, to have each trade verify that the pathway/raceway sizing is sufficient for the cabling to be installed within, to ensure a consistent installation for all cabling, to minimize interference with adjacent materials and equipment, and to ensure that communications cabling and equipment is accessible to the Owner for future modifications and maintenance. The meeting shall take place a minimum of 30 days prior to communications pathway/raceway rough-in. Attendees shall include:
      a. Communications System Contractor(s)
         1) Communications Cabling System
         2) AudioVisual Systems
         3) Others as applicable
b. Electrical Contractor

c. General Contractor

d. HVAC/Mechanical Contractor

e. Plumbing Contractor

f. Engineer

g. Owner

C. Inspections

1. The Contractor shall schedule and coordinate all inspections of the work as required by the Governing Authorities. The Contractor shall be solely responsible for scheduling inspections by the Governing Authorities at times appropriate to the stage of construction and the work to be inspected. The Contractor shall provide all assistance as required by the inspector(s) during their inspection(s).

   a. Should the Governing Authorities require remedial action on the Contractor’s part due to the failure of the Contractor to schedule inspections at appropriate times, such work shall be at no additional cost to the Owner.

   b. The Contractor is solely responsible for scheduling inspections such that, should the work fail inspection, enough time remains in the project schedule to take remedial action and re-inspect the installation.

D. Observation of Work

1. Work will be observed by the Engineer on a periodic basis. Work not found to be in compliance with the Construction Documents, or not in compliance with the intent of the Construction Documents, shall be brought into compliance at no additional cost to the Owner.

2. The Contractor shall notify the Engineer at least one week in advance of the covering of concealed work so that the Engineer may schedule on-site observation of the work to be concealed. Work shall not be concealed until work has been tested (if applicable), observed by the Governing Authorities (if applicable), and at the Engineer’s discretion, observed by the Engineer. Should work be concealed prior to such testing and observation, it shall be uncovered, tested, observed, and restored by the Contractor to the finished condition at no additional cost to the Owner.

E. Coordination

1. The Contractor shall thoroughly examine the Construction Documents, including Drawings and Specification Sections of other Divisions, shop drawings, or where equipment has been substituted or is proposed to be substituted for construction details and methods that are dependent upon or will affect the work of other trades. The Contractor is responsible for identifying coordination issues, discrepancies, conflicts and dependencies, and for preparing Shop Drawings, work plans and schedules to accommodate or mitigate coordination issues, discrepancies, conflicts and dependencies before they arise. Changes necessitated by the failure of the Contractor to coordinate with the work of other trades shall be at no additional cost to the Owner.

2. The Contractor shall confer and cooperate with the other trades, throughout the entire construction process, in order to coordinate the work in the proper sequence. Typical coordination issues include but are not limited to:
a. Electrical work, including but not limited to electrical receptacles, power panels, transformers, the telecommunications grounding system, and the installation of raceway, device boxes, conduits, cable tray, ladder racking and sleeves.

b. Mechanical work, including but not limited to HVAC systems and ductwork, piping, and mechanical chases.

c. Ceiling cavity spaces.

d. Installation of acoustical ceiling tiles and similar finishes that may conceal the work.

e. Build-in of oversized equipment during structure construction.

f. Required separation distances.

g. Access routes for equipment through the construction.

h. Cutting/coring of floor, ceiling or wall structures.

3. Verify that the physical dimensions of each item of equipment fit the available space, promptly notify the Engineer with documentation of any potential conflicts, and await the Engineer’s direction prior to purchase and rough-in of the equipment. Documentation shall include narrative explanation of potential conflict supported by drawings illustrating such with suggested solution.

4. Coordinate locations of devices with field conditions, unless such locations are specifically dimensioned or otherwise noted in the Construction Documents. If so noted, verify location with other affected trades and against existing field conditions, promptly notify the Engineer of any potential conflicts, and await the Engineer’s direction prior to purchase and rough-in of the equipment.

5. Coordinate locations for chases, slots, sleeves, and openings in the building structure. For new concrete coordinate, locate and provide chases, slots, sleeves, and openings prior to the pouring of the concrete.

6. Outages shall be coordinated and scheduled in advance with the Owner at a time and duration acceptable to the Owner. Outages scheduled at times other than the normal working hours shall not entitle the Contractor to additional compensation beyond the original amount bid. Outages without advance notice and prior approval by the Owner are not acceptable.

7. Furniture and Casework: Prior to procurement and installation of materials and equipment within furniture and casework, the Contractor shall coordinate with other trades and verify all locations, pathway requirements, etc. Materials and equipment installed in furniture and casework without prior coordination are solely at the Contractor’s risk, and as such, are subject to possible rejection by the Engineer. Rejected materials and equipment shall be replaced and modified furniture and casework shall be restored to its original condition at no additional cost to the Owner.

F. Verification and Validation

1. Measurements

   a. The Contractor shall physically verify and validate all measurements on site (i.e. actual measurements vs. those of the Drawings). Where discrepancies exist which could affect the Work or the Intent of the Construction Documents, the Contractor shall notify the
2. Raceway/Pathway Sizes
   a. Prior to procurement and installation of raceway/pathway, the Contractor is responsible for verifying and validating raceway/pathway (conduit, sleeves, cable tray, surface raceway, etc.) sizes with any and all trades which will make use of them.
      1) The Contractor, in conjunction with the various trades, shall determine the quantity, types, and outside diameters of the cables to be installed within each raceway/pathway, and shall verify the cable fill ratios for each pathway based upon this information. The cable fill ratios shall include spare capacity as required elsewhere within these Specifications or on the Drawings.
      2) Where the calculated cable fill ratios exceed that recommended by the NEC and TIA/EIA 569, where the ratios indicate that the raceway/pathway is of insufficient size, and/or where discrepancies exist between the raceway/pathway sizes shown on the Drawings and the Contractor’s calculated sizes, the Contractor shall notify the Engineer and await the Engineer's direction prior to procurement and installation of the raceway/pathway or cable.

3. Equipment locations
   a. Prior to the installation of equipment, the Contractor shall coordinate with other trades and subsequently verify all equipment locations that mount on walls or within ceilings. This work shall include but shall not be limited to:
      1) Structural elements such as lighting devices, HVAC equipment, fire protection devices, and cable tray.
      2) Structural support elements for ceiling mounted devices such as but not limited to speakers, cameras, projectors and projection screens.
      3) Backing Board for wall mounted devices such as but not limited to equipment panels, equipment panels, power supplies, head-end equipment, flat panel displays, speakers, and equipment room devices.

4. No additional compensation will be approved for additional work or materials required due to the Contractor’s failure to verify and validate the above.

G. Examination
   1. The Contractor shall carefully examine the project site and the Construction Documents and shall be responsible for identifying all utility, state, and local requirements that will affect the Work.
   2. The Contractor shall become familiar with the local conditions under which the work is to be performed and correlate those conditions with the requirements of the Construction Documents. No allowance will be made for claims of concealed conditions which the Contractor, exercising reasonable due diligence while examining the site, observed or should have observed.
   3. The Contractor shall be responsible for determining if the Work will affect the operation or code compliance of existing systems. Where this is the case, the Contractor shall notify the Engineer and await the Engineer's direction prior to procurement and installation.

1.3 SYSTEMS SPECIFIC QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)
A. In addition to the quality assurance processes and procedures specified above, the Contractor shall provide the following for each Communications System:

1. Communications Cabling System
   
a. Coordination:
      1) The Contractor shall review the Drawings and Specifications of other Divisions for locations of devices and equipment requiring communications connectivity not specified or shown on the Drawings of this Division. The Contractor shall coordinate the locations of these items with the other trades, and shall verify locations with the Engineer and Owner prior to rough-in.
      2) The Contractor shall facilitate and coordinate Service Providers installations with the Owner and with the Service Provider(s).
   
b. Verification: The Contractor shall physically verify the following on site, prior to procurement and installation:
      1) Backbone Cable: Verify total run lengths for each backbone cable (inside and outside plant) from origination to destination using the pathways provided (ductbank, conduits, raceway, conduit, cable-tray, sleeves, open/accessible pathways, etc.), and including slack loops, vertical transitions, jogs, etc. Pre-cut cables of insufficient length are the sole responsibility of the Contractor.
      2) Station Cable: Verify total run lengths for each station cable from outlet location to communications room using the pathways provided (conduit, cable tray, sleeves, open pathways, etc.), and including slack loops, vertical transitions, jogs, etc. For run lengths which may exceed 270 feet, the Contractor shall obtain the Engineer’s direction prior to proceeding with the installation.
   
c. Contractor RCDD Periodic Review:
      1) During the course of construction, the Contractor’s RCDD shall periodically perform an on-site review of the construction in progress and certify that the construction conforms to the requirements of the Governing Requirements, and in particular the TIA/EIA standards. The RCDD shall provide a written report to the Owner/Engineer on company letterhead that details the work reviewed and states that the work is in conformance with the Governing Requirements. The work in progress shall be reviewed and a report delivered to the Owner/Engineer on a bi-weekly basis.
   
d. Inspections:
      1) Inspections shall occur no later than one week after Substantial Completion. Furthermore, inspections shall be completed and certified no later than three weeks prior to the scheduled use of the system by the Owner.
         a) Manufacturer Inspection: The installation is required to pass all Manufacturer certification requirements.
            1. The completed installation shall be inspected by Manufacturer personnel, shall pass the Manufacturer inspection, and shall be certified by the Manufacturer to meet and be covered by the Manufacturer extended product warranty.
            2. The Contractor is solely responsible for all costs associated with scheduling the Manufacturer inspection, the inspection itself, and for making any modifications to the installation as required by the Manufacturer at no additional cost to the Owner.
b) RCDD Inspection: The installation is required to comply with the Governing Requirements.

1. The Contractor’s RCDD shall inspect the completed installation and prepare a certificate on company letterhead certifying that the work complies with the Governing Requirements. The written certification shall be complete with the RCDD’s stamp/certification number and shall bear the RCDD’s signature across the face of the stamp. The certification shall be submitted with the O&M documentation.

2. AudioVisual Systems

   a. Equipment locations: Prior to the installation of equipment, the Contractor shall coordinate with other trades and subsequently verify all equipment locations that mount on walls or within ceilings. This work shall include but shall not be limited to:

   1) Structural elements such as lighting devices, HVAC equipment, fire protection devices, and cable tray.

   2) Structural support elements for ceiling mounted devices such as projectors, projection screens, and speakers.

   3) Backing Board for wall mounted devices such as flat panel displays, speakers, and equipment room devices.

3. Electrical For Communications Systems

   a. Raceway/Pathway Size Validation: The Electrical Contractor is responsible for ensuring that the Raceway/Pathway sizes have been validated by all trades per the criteria set forth in Part 1 – General: General Quality Assurance/Quality Control (QA/QC), Verification and Validation, Raceway/Pathway Sizes above.

   1) Where discrepancies exist between the raceway/pathway sizes shown on the Drawings and the Contractor’s calculated sizes, the Contractor shall notify the Engineer and await the Engineer's direction prior to procurement and installation of the raceway/pathway.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 27 00 50
SECTION 27 00 60

TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines training requirements for the various communications systems.

1.2 GENERAL REQUIREMENTS

A. Trainer/Instructor

1. The Instructor leading the training session(s) shall be a qualified and experienced trainer. Where the Contractor does not have a qualified and experienced trainer on staff, the Contractor shall arrange to have appropriate Manufacturer Representative(s) lead the training session(s).

2. The Contractor shall have the Project Manager and/or Foreman present during the training session(s) in order to assist the Instructor by providing “hands-on” operational knowledge of the installation and operations of the systems.

3. For complex/sophisticated equipment, the Contractor shall arrange to have the appropriate Manufacturer Representatives present during the training session(s).

B. Schedule and Location

1. The date and time of the training session(s) shall be coordinated with and approved by the Owner and Engineer. The Engineer may attend the training session(s) at the Engineer’s discretion.

2. The training session(s) shall occur within one month of Substantial Completion, unless otherwise approved by the Owner.

3. Training session(s) shall occur at the site, in order to provide the participants with “hands-on” experience.

4. Training may not necessarily occur in contiguous periods, depending upon the needs of the Owner (e.g. if a total of 8 hours of training is required, depending upon the needs of the Owner, it may be that two 2-hour periods and one 4-hour period spread across several weeks may be necessary).

C. Follow-up Training

1. Unless otherwise noted, provide one follow-up training session during the Warranty Period, scheduled at the request of the Owner. The follow-up training session shall occur after the Owner has had the opportunity to fully operate the system(s). The Contract shall not be considered complete until training has been completed.

PART 2 - MATERIALS

2.1 GENERAL

A. The final version of the O&M Manual(s) shall be used as the primary training aid.
B. Training materials and presentations shall be professional in appearance, organized, bound, and suitable for re-use by the Owner in the future. Provide training materials to each participant, plus an additional 10 copies to the Owner for future use. Training materials shall be provided on CD-ROM in addition to hardcopy.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall provide training on the proper operation and routine maintenance of the various communications systems. Training shall include “hands-on” demonstrations.

B. Training shall not commence until the communications system(s) are complete, tested, and fully operational.

3.2 TRAINING

A. Provide training for each Communications System as follows:

1. Communications Cabling System
   a. Training Session(s)
      1) Provide a total of 30 minutes of training, broken out approximately as follows:
         a) Overview of the Communications Cabling System and Warranty process
         b) Horizontal Cabling System and Labeling
         c) Communications Rooms
      b. Videotaping: Not required.
      c. Follow-up Training: Not required.

2. AudioVisual Systems
   a. Training Session(s)
      1) Provide a total of 3 hour(s) of training, broken out approximately as follows:
         a) Overview of the Audio Visual Systems and Warranty process: Provide 1 hour of training
         b) AV systems: Provide 1 hour of training
         c) Follow-up Training: Provide 1 hour of training

3. Electrical For Communications Systems
   a. Not required.

END OF SECTION 27 00 60
SECTION 27 04 05
COMMON WORK - SLEEVES, PENETRATIONS, AND FIRESTOPPING

PART 1  - GENERAL

1.1 SUMMARY
A. This Section includes specific requirements for sleeves and penetrations common to the communications systems.

1.2 RELATED SECTIONS
A. The firestopping requirements of this Section are additional to, different from, or otherwise supplement the Section(s) in Division 7 which pertain(s) to thermal protection systems, such as firestopping and fire-resistant materials. The applicable requirements of these Section(s) shall serve as the basis for the requirements of this Section, and are incorporated by reference into this Section.
B. General requirements are covered in Division 27 Specification Section Electrical Technology - General Requirements.

1.3 SUBMITTALS
A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section Basic Communications Requirements:
   1. Product Data

1.4 DEFINITIONS
A. EMT: Electrical Metallic Tubing
B. RMC: Rigid Metal Conduit

PART 2  - MATERIALS

2.1 GENERAL
A. Part Numbers: Refer to the Equipment Schedule on the Technology Drawings for specific part numbers. If no part number is provided, then any part meeting the manufacturers and requirements specified is acceptable.

2.2 SLEEVES
A. Provide sleeves for all locations where cable must pass-through building barriers such as walls, floors or foundations.
B. Sleeves consist of conduit section(s), Cable Pathway Wall Penetration Sleeve Device(s) or Cable Pathway Firestopping Device(s) passing through a penetration/opening in a barrier.
C. Conduit sections used for sleeves shall be per the requirements of Division 27 Specification Section Electrical Technology - Conduit and Boxes.
D. Conduit Sleeves shall be:
   1. Cast-in-place: Provide RMC conduit sections unless otherwise shown on the Drawings
   2. Cored: Provide EMT conduit sections unless otherwise shown on the Drawings
   3. Non fire-rated barriers: Provide EMT conduit sections unless otherwise shown on the Drawings
E. Fire-rated Sleeves shall be:
   1. For barriers other than floors: Cable Pathway Firestopping Device
      a. Devices shall be pre-manufactured enclosed fire rated pathway devices with a built-in fire
         sealing system sufficient to maintain the hourly rating of the barrier being penetrated. The
         self-contained sealing system shall automatically adjust to the installed cable loading and
         shall permit cables to be installed, removed, or maintained without the need to remove or
         reinstall firestop materials. The pathway shall be UL classified and FM/Systems
         approved, and shall be examined and tested to the requirements of ASTM E814 (UL1479).
         Use shall be per local codes. Sleeves shall be:
            1) Specified Technologies, Inc.: EZ-Path
            2) Wiremold: FlameStopper
            3) Or approved equal

2.3 FIRESTOPPING

A. General:
   1. Provide firestopping material for all through and membrane penetrations of fire-rated barriers.
   2. Firestopping material used to seal open penetrations through which cable passes shall be re-
      usable/re-enterable.
   3. Provide through-penetration firestop products that are compatible with one another, with the
      substrates forming openings, and with the penetrating items.
   4. Provide firestop products that upon curing do not re-emulsify, dissolve, leach, breakdown or
      otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding
      water or other forms of moisture characteristic during and after construction.
   5. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water
      hammer, thermal expansion and other normal building movement without damage to the seal.
   6. Materials or sealants shall not contain flammable solvents or sodium silicate.
   7. Products specified in this Section shall be UL Listed and Labeled.

B. Firestopping Materials
   1. Material shall conform to both Flame (F) and Temperature (T) ratings as required by local
      building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire
      test in a configuration that is representative of the actual field conditions. Materials shall be
      complete with necessary accessory materials, as applicable, for complete UL listed and approved
      assemblies.
a. Firestopping materials shall be manufactured by:
   a) Specified Technologies, Inc.
   b) 3M
   c) Or approved equal

PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section *Basic Communications Requirements*. Governing Requirements of particular relevance to this Section include, but are not limited to:

1. NEC: National Electrical Code (NFPA Article 70)
2. TIA/EIA 569: Commercial Building Standard for Telecommunication Pathways and Spaces

B. Installation shall be such that communications circuits, when installed in the pathways and penetrations specified herein, are able to fully comply with the following:

1. TIA/EIA 568: Commercial Building Telecommunications Cabling Standard

3.2 SLEEVES

A. Provide sleeves for all locations where free hung cable must pass through building barriers such as walls, floors or foundations.

B. The Contractor shall provide all cutting, rough patching and finish patching as required for the installation of sleeves, and shall provide all penetrations, including core drilling, roto-hammering, etc. as required.

C. Sleeves shall be sealed and firestopped (as appropriate to the fire rating of the barrier) between the conduit section (or cable pathway firestopping device) and the barrier penetration/opening.

D. Unless otherwise noted on the Drawings or specified herein, sleeves shall be sized according to the quantity and outside diameter of the cable(s) they are to support per NEC fill ratios and TIA/EIA 569 cable capacity standards, plus an additional 25 percent for future expansion.

E. Sleeve size shown on the Drawings reflects the size of the conduit or device passing through, not the size of the penetration/opening.

F. Conduit section sleeves:

1. Conduits shall be installed per the requirements of Division 27 Specification Section *Electrical Technology - Conduit and Boxes*.
2. Unless otherwise noted on the Drawings, sleeve size through floors shall be 4 inch diameter.
3. Conduit sections shall be installed complete with insulated throat bushings.

G. Cable Pathway Firestopping Device:
1. Provide where cable trays must pass through fire rated barriers. Transition from cable tray to Cable Pathway Firestopping Devices at fire rated barriers.
   a. Provide sufficient quantity of cable pathway firestopping devices such that the combined useable cross sectional area of the devices matches or exceeds the cross sectional area of cable tray to be served.

2. Provide where free hung cables must pass through fire rated barriers.
   a. Provide sufficient quantity of cable pathway firestopping devices such that the combined useable capacity of the devices is a minimum of 150% of the cable to be.

H. Fire Rated Floor Penetration Assembly:
   1. Provide where shown on Drawings.

3.3 INSTALL STRICTLY IN ACCORDANCE WITH MANUFACTURER’S INSTALLATION GUIDE AND APPLICABLE CODES

3.4 PENETRATIONS

A. Properly size and locate penetrations required as construction progresses. For new concrete or masonry the Contractor shall coordinate, locate and provide required openings prior to the pouring of concrete or construction of masonry.

B. Penetration of concrete and structural elements shall be avoided where possible. Where not possible, obtain written approval from the Structural Engineer/Architect prior to penetration. Such penetrations shall be performed in a manner that will not reduce structural element load-carrying capacity or load-deflection ratio.

C. Penetrations shall be performed by workers qualified and skilled in the trades involved.

D. Penetrations (through and membrane) of fire rated barriers shall be firestopped and sealed. The fire rating of the barrier shall be strictly maintained.

E. Penetrations shall not be exposed on the exterior or in occupied spaces in a manner that would, in the Engineer’s opinion, reduce the aesthetic qualities of the structure or result in visual evidence of penetration and patching.

F. Penetrations shall be constructed using methods least likely to damage elements to be retained or adjoining construction.
   1. Provide temporary support for the work to be penetrated.
   2. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not for hammering or chopping. Cut holes and slots neatly to required size with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring of existing finished surfaces.
   4. Cut through concrete and masonry using a cutting device such as a Barborundum saw or diamond core drill.
G. Voids around penetrations shall be properly sealed, caulked or grouted as required.

H. Existing elements:
   1. The Contractor shall be responsible for identifying, locating, and protecting existing elements such as embedded conduits, pipe, ductwork, etc. when penetrating existing structures.
   2. Cap, valve, plug or seal remaining portions of cut pipes or conduit to prevent entrance of moisture or other foreign matter.
   3. The Contractor shall be responsible for repairing or replacing existing conduits, pipe, ductwork, etc. damaged by the Contractor during construction of penetrations. Repair or replacement shall be made at no additional cost to the Owner.

I. Penetrations (and subsequent patching) resulting from the Contractor’s failure to properly coordinate penetrations shall be at no additional cost to the Owner.

J. Penetrations shall be laid out and installed in advance to facilitate the installation of raceway through the penetrations.

3.5 FIRESTOPPING

A. Work shall be in accordance with the UL Fire Resistance Directory, fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and codes.

B. Application of sealing material shall be accomplished in a manner acceptable to the local fire and building authorities.

C. The fire rating of all penetrated fire barriers shall be strictly maintained. All through penetrations as well as membrane penetrations of fire rated barriers shall be firestopped and sealed.

D. Installation shall be performed in strict accordance with manufacturer’s detailed installation procedures. Prepare surfaces per manufacturer’s instructions. After installation, clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling.

E. Personnel installing firestopping products shall be certified by the Manufacturer to install such products.

F. Install firestopping in open penetrations and in the annular space of penetrations for fire rated barriers.

G. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.

H. Install firestopping such that the performance and effectiveness of other thermal and fire protective devices (such as fire/smoke dampers) in the area are fully maintained.

I. Install putty pads in conjunction with metallic boxes where size or aggregate area of such boxes exceed limits established by the governing requirements.

J. Protect materials from damage on surfaces subjected to traffic.

K. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.
L. Where joint application is exposed to the elements, fire resistive joint sealant must be approved by the manufacturer for use in exterior applications and shall comply with ASTM C-920.

M. Do not install firestop products when ambient or substrate temperatures are outside limitations recommended by the manufacturer.

N. Do not install firestop products when substrates are wet due to rain, frost, condensation or other causes.

O. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing openings.

P. Firestopping devices shall not act as supports.

END OF SECTION 27 04 05
SECTION 27 04 06
COMMON WORK - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes specific requirements for hangers and supports within the Communications Pathway System. General requirements are covered in Division 27 Specification Section Electrical Technology - General Requirements.

1.2 RELATED SECTIONS

A. The requirements of Division 27 Specification Section Electrical Technology - General Requirements shall serve as the basis for the requirements of this Section, and are incorporated by reference into this Section.

1.3 SUBMITTALS

A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section Basic Communications Requirements:

1. Product Data

1.4 DEFINITIONS

A. Hanger/Support System: All equipment, materials, and incidentals required to support the raceway/pathway and cabling systems, including but not limited to metallic hangers and supports, conduit, cable tray, conduit, pull boxes, device boxes, u-channels, threaded rods, clamps, concrete inserts, anchor bolts, cables, backing boards, etc.

PART 2 - MATERIALS

2.1 GENERAL

A. Part Numbers: Refer to the Equipment Schedule on the Technology Drawings for specific part numbers. If no part number is provided, then any part meeting the manufacturers and requirements specified is acceptable.

2.2 HANGERS AND SUPPORTS

A. A complete Hanger/Support System shall be provided to support all components of the raceway/pathway and cabling systems.

B. The Contractor shall provide all materials, labor and incidentals as required for a complete Hanger/Support System.

C. The Hanger/Support System shall be of corrosion resistant or galvanized steel, shall be of an approved standard design, and shall be constructed to maintain the supported load in proper position and alignment under all operating conditions. Manufacturer shall be:
1. B-line
2. Caddy/Erico
3. Kindorf
4. Unistrut
5. or Equal

2.3 CABLE SUPPORTS (J-HOOKS, STRAPS)

A. Cable supports exterior to Communications Equipment Rooms:
   1. There shall be no exposed cables.

B. Cable straps within Communications Equipment Rooms:
   1. Cable Straps shall be used within communications rooms and spaces and shall be provided for strapping groups of cables to raceway and for controlling/managing patch cables. The use of plastic tie wraps for this purpose is not acceptable. Cable straps shall be self-gripping, reusable, constructed of Velcro, and hook-and-loop style. Cable straps shall be plenum or non-plenum rated to match that of associated cable. Cable straps shall be manufactured by:
      a. Velcro
      b. Siemens
      c. Panduit
      d. Approved Equal
   2. Size: Cable strap size shall be:
      a. For Patch Cables: ½ inch wide and minimum 8/maximum 12 inches in length.
      b. For Horizontal Cables: ½ inch wide and minimum 8/maximum 12 inches in length.
      c. For Backbone Cables: ¾ inch wide and minimum 12/maximum 18 inches in length.
   3. Color: Cable strap color shall be the same color as the cable color of the bundle to be strapped.

PART 3 - EXECUTION

3.1 HANGERS AND SUPPORTS

A. Hanger/Support system shall be installed in such a manner as to prevent any strain being imposed on the equipment supported.

B. Coordinate with the building structure and the work of other trades.

C. Install individual and multiple trapeze raceway hangers and riser clamps as necessary to support raceways. Provide all incidental materials as necessary for hanger assembly and for securing hanger rods and conduits. Use 3/8 inch diameter or larger all-thread rods for support.
D. NEC requirements:
   1. Hangers and supports shall be installed at required intervals.
   2. Conduit, hangers and supports, cable, or infrastructure related to technology systems, shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent (dedicated) means of secure support shall be provided.
   3. Wires provided as dedicated hangers for supports shall be secured at both ends, such as the structural ceiling at one end and the suspended ceiling grid at the other end, and shall be distinguishable from wire used to support the suspended ceiling assembly by color, tagging, or other effective means.

E. In exposed structural ceiling spaces, where no suspended ceiling assembly is indicated, wire shall not be used as a hanger for supports.

F. Strength of each support shall be adequate to support a minimum of five times the present and future load. A minimum of 200 pound safety allowance for each support is required.

G. Cut threaded rods such that the bottoms have a maximum length of thread below the bottom nut equal to that of the rod diameter (i.e. a 3/8 inch rod would have a maximum length of 3/8 inches below the bottom nut).

H. Conduit and box support installation shall prevent displacement of conduit and box in any direction.

I. Provide plastic or rubber end caps for all Hanger/Support System components which are readily accessible and exposed to personnel.

J. Anchor Methods:
   1. Hollow Masonry: Toggle bolts or spider type expansion anchors.
   3. New Concrete: Preset inserts with machine screws and bolts.
   4. Existing Concrete: Steel expansion bolts or explosive powder driven inserts.
   5. Wood surfaces: Wood screws.
   6. Steel: Welded threaded studs or galvanized steel clamps.
   7. Light Steel: Sheet metal screws.

K. Firestopping devices shall not act as supports.

3.2 CABLE SUPPORTS (J-HOOKS, STRAPS)

A. Exterior to Communications Equipment Rooms:
   1. There shall be no exposed cables.

B. Within Communications Equipment Rooms:
1. Install cable straps to secure cable bundles (see below) to cable runway and other supporting equipment. The use of plastic tie wraps for this purpose is not acceptable.

a. Bundling:
   1) Cables shall be bundled by application (patch, horizontal, backbone) and by cable type (Cat 3, Cat 5E, Cat 6, Cat 6a, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a bundle.
   2) Cable bundles (of a given application and cable type) shall consist of relatively even cable quantities.

b. Quantity of cable per cable bundle shall be as follows:
   1) For Patch Cables: 24 to 48 patch cables per cable bundle with straps applied at 1 foot intervals.
   2) For Horizontal Cables: 50 to 100 horizontal cables per cable bundle with straps applied at 3 foot intervals.
   3) For Backbone Cables: 4 to 8 backbone cables per cable bundle with straps applied at 3 foot intervals.

c. Provide excess cable straps to Owner.

**END OF SECTION 27 04 06**
SECTION 27 05 00

ELECTRICAL TECHNOLOGY - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general requirements for raceway, pathways, grounding and bonding, and other electrical infrastructure necessary for the support of communications systems.

1.2 RELATED SECTIONS

A. The requirements of this Section are additional to, different from, or otherwise supplement similar Section(s) in Division 26. The applicable requirements of those Section(s) shall serve as the basis for the requirements of this Section, and are incorporated by reference into this Section.

B. Division 27 Specification Section Common Work - Sleeves, Penetrations and Firestopping. Provide sleeves, penetrations, and firestopping as required to support the work of this Section.

C. Division 27 Specification Section Common Work – Hangers and Supports. Provide hangers and supports as required to support the work of this Section.

1.3 SUBMITTALS

A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section Basic Communications Requirements:

1. Product Data

2. Shop Drawings:

a. Raceway/pathway routing plan (including, but not limited to exposed, underslab, underfloor, and OSP conduit/ducts):

1) Shop drawings shall show proposed raceway/pathway routing and applicable pullbox locations and sizing for Owner and Architectural review.

a) The design intent is that raceways/pathways will be racked and trained, with a neat appearance and consolidated with the routing of electrical raceways/pathways similar to the images included at the end of this specification section.

2) Provide a routing plan that shows full coordination with structural elements and all other disciplines. The routing plan shall include:

a) Complete floor plans or detail drawings showing the proposed routing, raceway and pullbox sizes and locations and structural blockout/penetration sizes and locations submitted in a manner equal to that of the Construction Drawings.

1. Structural blockout/penetration sizes and locations shall be approved by the structural engineer.
b) A statement that the proposed routing has been coordinated with electrical, HVAC, plumbing, and other trades, and that comparable changes have been made to the cabling systems making use of the routing. Specifically note each location where the proposed routing is different from the Drawings, and the reason for the deviation.

c) Routing deviations must be approved in writing by the Engineer prior to proceeding with installation.

3. Other:
   a. Owner Specific: Submit other information as required by Owner Specific Governing Requirements in Specification Section Basic Communications Requirements.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section Basic Communications Requirements. Governing Requirements of particular relevance to this Section include, but are not limited to:

1. NEC: National Electrical Code (NFPA Article 70)
2. TIA/EIA 569: Commercial Building Standard for Telecommunication Pathways and Spaces
3. TIA/EIA 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
5. ANSI J-STD-607: Commercial Building Grounding and Bonding Requirements for Telecommunications

B. Installation shall be such that communications circuits, when installed in the pathway systems specified herein, are able to fully comply with the following:

1. TIA/EIA 568: Commercial Building Telecommunications Cabling Standard

C. The Contractor shall pay particular attention to and comply with the following Owner Governing Requirements:

1. Auraria Cooperative Telecommunications Committee – Universal Cable Plant IT Services – Building Infrastructure Distribution Systems Guidelines, Methods and Standards (latest edition)

D. Unless otherwise noted on the Drawings or specified herein, communications raceway/pathways (conduit, sleeves, cable tray, surface raceway, etc.) shall be sized according to the quantity and outside diameter of the cable(s) they are to support per NEC fill ratios and TIA/EIA 569 cable capacity standards, plus an additional 25 percent for future expansion.

E. Firestopping: All penetrations of fire rated barriers shall be firestopped and sealed. The fire rating of all fire barriers shall be strictly maintained.
F. Labels/identification: Label and identify components of the pathway system per TIA/EIA 606.

END OF SECTION 27 05 00
SECTION 27 05 33
ELECTRICAL TECHNOLOGY - CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes specific requirements for conduits and boxes within the Communications Pathway System. General requirements are covered in Division 27 Specification Section Electrical Technology - General Requirements.

1.2 RELATED SECTIONS

A. The requirements of Division 27 Specification Section Electrical Technology - General Requirements shall serve as the basis for the requirements of this Section, and are incorporated by reference into this Section.

B. Division 27 Specification Section Common Work - Sleeves, Penetrations and Firestopping. Provide sleeves, penetrations, and firestopping as required to support the work of this Section.

C. Division 27 Specification Section Common Work – Hangers and Supports. Provide hangers and supports as required to support the work of this Section.

1.3 SUBMITTALS

A. Comply with the Submittal portion of Division 27 Specification Section Basic Communications Requirements. Provide submittal information for the following:

1. Product Data

1.4 DEFINITIONS

A. EMT: Electrical Metallic Tubing

B. RMC: Rigid Metal Conduit

C. RNC: Rigid Nonmetallic Conduit

D. IMC: Intermediate Metal Conduit

E. Back Box: A pre-manufactured metallic or non-metallic box mounted within a floor, wall or ceiling and used to hold Communications Systems outlets/connectors, transition devices or equipment.

F. Device Boxes: Device boxes are Back Boxes that serve as a support point and/or an enclosure for various Communications Systems (Audiovisual Systems, Communications Cabling (Telecom) System, and Security Systems) devices. Device boxes for Communications Systems devices other than Communications Cabling System devices typically have manufacturers’ specific requirements that are identified elsewhere in the Construction Documents.

G. Outlet Box(es): Outlet box is another term used for Device Box.
PART 2 - MATERIALS

2.1 GENERAL

A. Part Numbers: Refer to the Equipment Schedule(s) on the Technology Construction Drawings for specific manufacturers and part numbers. If no part number is provided, then any part meeting the manufacturer and requirements specified is acceptable.

B. Refer to all of the Communications (Technology) System Details on the Technology Construction Drawings for additional requirements including, but not limited to Outlet Box size, Mud Ring gang size, conduit size and quantity and conduit routing. The Outlet Box size, Mud Ring gang size, conduit size and quantity and conduit routing requirements in the Details supersede the general Outlet Box size, Mud Ring gang size, conduit size and quantity and conduit routing requirements listed in this specification.

2.2 CONDUIT

A. Conduit types:

1. EMT shall be steel, hot-dipped galvanized or electro-galvanized, with an inner coating to protect cables and aid pulling, UL listed, and meeting the requirements of UL 797 and ANSI C80.3.

2. RMC shall be steel, hot-dipped galvanized inside and outside with factory threaded ends full cut and galvanized after threading, UL listed, and meeting the requirements of UL 6 and ANSI C80.1.

3. RNC shall be PVC Schedule 40 rigid plastic unless otherwise noted on the Drawings, shall be rated for use with 90 degree C wire, and shall conform to UL 651, WC-1094C and NEMA TC 2.

4. RNC Type EB-20 shall be provided as shown on the drawings, shall be ETL listed, tested to UL-651-A, and shall meet the requirements of NEMA TC-6 and ASTM F-512.

5. Flexible (flex) conduit: Flex conduit is not approved and not acceptable. Where, in rare instances, flex conduit is the only remaining viable raceway option, the Contractor shall notify the Engineer and await the Engineer’s direction prior to procurement and installation.

6. Condulets (LB’s): Condulets (LB’s) are not approved and are not acceptable.

B. Fittings:

1. Provide fittings as follows:

a. EMT fittings shall be steel compression type with a nylon insulated throat for rain-tight and concrete-tight applications, steel set screw type or steel compression type for all other connections. Conduit ends shall be fitted with bushings – bushings shall be threaded type for RMC and IMC, set screw type for EMT, and have a nylon insulated throat.

b. RMC fittings shall be threaded galvanized steel. Conduit ends shall be fitted with bushings – bushings shall be threaded and have a nylon insulated throat.

c. RNC fittings shall be of same material and manufacturer as the conduit, shall be UL listed and conform to UL 514. Cement shall be as recommended by manufacturer.

2. Expansion fittings shall be provided across structural joints, shall be of a design to compensate for expansion and contraction, shall be sealed to prevent entrance of water and moisture, and shall
safely deflect and expand up to twice the distance of the structural movement. Expansion fittings shall be approved for grounding duty.

2.3 INNERDUCTS (SUBDUCTS)

A. Innerducts: Provide in locations shown on Drawings.

1. Provide Innerduct(s) to enclose and protect all fiber optic cables in the locations noted on the Technology Construction Drawings. Innerducts shall be plenum or non-plenum rated to match that of associated cable and include a 2400 pound strength sequentially numbered pull tape, or equal. Innerducts shall be manufactured by:

   a. Carlon
   b. Engineer approved equal

2.4 JUNCTION BOXES

A. Junction boxes shall be provided to serve as a transition point between pathways/raceways. Junction boxes shall be galvanized stamped steel, deep drawn one piece (without welds or tab connections), with knockouts for conduit entrances, meeting NEMA OS 1.

B. Junction boxes shall not be used to support Communications System equipment.

C. Junction boxes shall not be placed in walls or non-accessible ceiling locations unless specifically shown on the Technology Drawings or approved in writing by the engineer prior to rough-in and installation.

D. Junction boxes in locations other than walls shall be sized according to the NEC.

E. Junction boxes in walls where specifically shown on the Technology Drawings or approved:

   1. Unless otherwise shown on the Drawings, junction boxes shall be minimum 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep with blank cover, and knockouts pre-manufactured to support the conduit size serving the junction box (i.e. field modifications of the junction boxes to support the conduit sizes specified are not acceptable).

   2. Size according to the NEC and provide the larger of the minimum size mentioned above or the NEC requirements.

2.5 DEVICE BOXES

A. General: Unless otherwise shown on the Drawings or specified herein, device boxes shall:

   1. Be rated for the specific installation per the NEC.

   2. Be galvanized stamped steel, deep drawn one piece (without welds or tab connections), with knockouts for conduit entrances, meeting NEMA OS 1, and equipped with extension rings to suit construction and application, unless required otherwise per the NEC.

   3. Have knockouts pre-manufactured to support the conduit size serving the outlet box (i.e. field modifications of the outlet box to support the conduit sizes specified are not acceptable).

B. Device Box Types:
1. Device Box: Typically installed as an empty box with blank faceplate, conduit and pull string for future use, unless specifically noted otherwise on the Technology Construction Drawings.
   a. Shall be a minimum 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep capable of accepting a minimum of (2) 1 inch conduits.
   b. Shall be equipped with a minimum single-gang mud ring unless otherwise noted on the Drawings.
      1) Mud ring depth shall be sized according to the depth of the wall surface per the Architectural Construction Documents.
   c. Provide a blank faceplate to match the material, style and color being used on the Electrical Wiring Devices.

2. Outlet Box: Outlet boxes shall be provided to house Communications Cabling System outlets/connectors:
   a. Shall be a minimum 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep capable of accepting a minimum of (2) 1 inch conduits
   b. Shall be equipped with a minimum 3/4-inch single-gang mud ring unless otherwise noted on the Drawings or specified as follows:
      1) For Wireless Access Point (WAP) locations: Provide a blank cover plate in lieu of single-gang mud ring.

3. AudioVisual Systems:
   1) Refer to Communications (Technology) System Details on the Technology Construction Drawings and Manufacturers requirements. Coordinate with AudioVisual contractor prior to rough-in. Receive written directions as to device box requirements for each location.
   2) Shall be a minimum 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep capable of accepting a minimum of (2) 1-1/4 inch conduits and a double-gang mud ring.

2.6 PULL BOXES

A. Pull Boxes shall be code gauge sheet metal/fabricated steel continuously welded at seams and painted after fabrication. Boxes shall be complete with covers, trim, etc.
B. Minimum pull boxes sizes shall be as follows:

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C. Pull Boxes for conduits sized larger than shown in the table above shall be provided as shown on the Drawings.

2.7 FLOOR BOXES

A. Floor boxes shall provide the interface for power, communication and/or audio/visual cabling in an above grade floor. Floor boxes shall be flush style, shall exceed UL scrub water exclusion requirements for tile and carpet floors, and shall be complete with covers, brackets and hardware to support installation as shown on Drawings.

1. Floor boxes may be combined for use by both power and communications where shown on the Drawings. When combined, provided metal dividers separating power from communications and provide separate conduits for power and communications.

2. Floor boxes shall be complete with brackets, cover plates, and/or other means to support power, communications, and/or audio-visual type connectors shown on the Drawings or called for in the Specifications.

B. Floor Box Types:

1. Deep Floor Box (8-gang): Floor boxes shall be in a recessed box, shall be adjustable before concrete pour, and shall be complete with brackets to support power, communications, and/or audio/visual type connectors as shown on the Drawings and specified in Specifications.

C. Floor Box Covers: Covers shall be provided for each floor box, shall support carpet/floor trim to match surrounding floor area, shall be UL listed to safety standards for tile, carpet and wood floor installation, and shall prevent water, dirt, and debris from entering power/communication/audio/visual outlets. Covers shall incorporate floor box manufacturer’s protection to prevent water, dirt, and debris from entering the power and communication devices, and shall meet or exceed UL scrub water exclusion requirements for tile and carpet floors. Coordinate color with Architect and Owner. Cover type shall be:

1. Cast Aluminum

2.8 OTHER BOX TYPES AND REQUIREMENTS

A. Refer to all of the Communications (Technology) System Details on the Technology Construction Drawings for additional requirements.
PART 3 - EXECUTION

3.1 CONDUIT

A. General:

1. Run conduit in the most direct route possible, parallel and perpendicular to building lines.

2. Route conduits as close to structure as possible.

3. Do not route conduit through areas in which flammable material may be stored, or over or adjacent to boilers, incinerators, hot water lines, or steam lines.

4. Conceal all conduit unless indicated otherwise, within finished walls, ceilings, and floors.

5. Keep conduits at least 6-inches away from parallel runs of flues and steam or hot water pipes.

6. Install conduits level and square and at proper elevations.

7. For conduit runs exceeding more than 100 feet in length, provide pull boxes (see Part 3 – Execution, Pull Boxes herein) so that no conduit segment between end points/pull boxes exceeds 100 feet.

8. For conduit runs which require more than two 90 degree bends, install pull boxes (see Part 3 – Execution, Pull Boxes herein) so that no conduit segment between end points/pull boxes contains more than two 90 degree bends.

9. Ream all conduits to eliminate sharp edges. Conduits shall be reamed after threads are cut.

10. Joints shall be cut square and shall butt solidly into couplings.

11. Terminate all metal conduits with metallic threaded insulated throat bushings, PVC conduit with PVC bushings.

12. Metallic conduits entering communication rooms shall be equipped with grounding lugs.

13. Prevent foreign matter from entering conduits by using temporary closure protection. After cable installation, cap each unused conduit with a mechanical-type seal (tape is not acceptable).

14. Conduits shall be installed in such a manner as to keep exposed threads to an absolute minimum and in no case shall more than three threads be left exposed.

15. Install expansion fittings where conduit crosses an expansion join in structure or is in an environment where temperature changes combined with conduit run length may produce expansion or contraction stress. Provide a flexible bonding jumper at least three times the nominal width of the joint.

16. Terminate conduits that protrude through a floor 1 to 3 inches above the surface of the floor.

17. Conduits shall be cleaned and dried prior to the installation of cables.

18. Route conduit through roof openings for piping and ductwork wherever possible. Where not possible, provide and route through roof jack with pitch pocket for waterproofing. Empty conduits passing through roof penetrations shall be capped and sealed weather tight.
19. Conduits passing through exterior walls and floors below grade shall be made watertight with duct plugs. Pipe sleeves and wall collars shall extend all around the conduit or entrance seals and be specifically manufactured for that purpose.

20. When using RNC, transition to RMC for all bends, stub-ups, and penetrations through foundation walls.

B. Conduit Schedule:
   1. Buried or below grade level slab: RNC
   2. Embedded in concrete slab: RNC
   3. Through foundation walls: RMC
   4. Corrosive/Hazardous Areas: RMC
   5. Exposed or subject to mechanical injury: RMC
   6. All other areas (unless otherwise noted): EMT

C. Minimum Conduit Sizing, where not shown on the Drawings:
   1. Junction Boxes in walls: 1 inch.
   2. Device Boxes: 1 inch.
   3. Pull Boxes: Provide per the Drawings.

D. Conduit bends:
   1. A conduit bend shall not exceed 90 degrees and shall not be constructed in such a way as to reduce the effective diameter of the conduit.
   2. Conduit bends shall be sweeping, shall conform to TIA/EIA 569 bend radius requirements, and shall be a minimum of no less than 6 times the internal diameter of the conduit for conduits 2-inches or less and a minimum of no less than 10 times the internal diameter of the conduit for conduits greater than 2-inches.
   3. For conduits larger than 1-1/4 inch, bends shall be factory-manufactured. Bending conduit larger than this in the field using manual or mechanical methods is not acceptable. 1 inch and 1-1/4 inch bends shall be made in an approved bending machine or shall be factory-manufactured.
   4. The contractor shall test each conduit with a mandrel to prove compliance with TIA/EIA and cable manufacturer bend radius requirements throughout the conduit run and shall provide evidence of such testing immediately upon request of the Engineer.
   5. The sum total of conduit bends for a conduit segment between end points/pull boxes shall not exceed 180 degrees, except one additional bend of up to 90 degrees is acceptable if the bend is located within 12 inches of the cable feed end.
   6. 90 degree condulets (LB’s) are not acceptable.

E. Conduit Stubs:
1. From boxes in partition walls: Conduit stubs shall extend a minimum of 6-inches above top of partition wall and shall be angled 30 degrees toward the nearest raceway/pathway for horizontal cabling.

2. To cable tray: Terminate conduits 2 to 4 vertical inches above the tray and within 2 horizontal inches of the edge of the tray. Conduits shall not extend over the edge of the cable tray.

3. Through floor slabs: Arrange so curved portion of bend (if any) is not visible above finished slab.

F. Conduit/duct runs under slab: Coordinate with other trades (electrical, plumbing, etc.) prior to trenching and installation. Communications conduit/duct runs under slab shall not share a trench with conduit/duct runs from other trades.

G. Conduits embedded in slab: Not acceptable unless otherwise shown on the Drawings.

H. Pull String for horizontal and systems cable:
   1. Equip all conduits over 3 feet long with plastic or nylon pull strings with printed footage indicators and a minimum test rating of 200 pounds. Extend pull string a minimum of 3 feet from each end. Pull strings shall be secured to avoid losing the pull string within the conduit by either securing tying the end of each string in place, or by tying the end of each string to a washer with a diameter larger than the conduit diameter.
   
   2. Label each pull string in a clear manner by designating, at each end of the pull string, the location of the far end of the pull string (i.e. room name, communications closet name, pull box identifier, cable tray, station identifier, etc.). Indicate pull string length on the label.

I. Pull Ropes for backbone cable (Inside and Outside Plant):
   1. Equip all conduits, over 3 feet long with 2400 pound test sequentially numbered pull tape, or equal. Where such conduits have innerducts, provide a 2400 pound test sequentially numbered pull tape (or equal) for each innerduct. Polyrope is not permitted. Pull rope shall be secured to avoid losing the pull rope within the conduit by either tying the end of each rope in place, or by tying the end of each rope to a washer with a diameter larger than the conduit diameter. Pull rope shall be exposed a minimum of 3 feet at the end of interior conduits and 10 feet at the end of exterior or underground conduits (ducts).
   
   2. Label each pull rope in a clear manner by designating, at each end of the pull rope, the location of the far end of the pull rope (i.e. manhole name, communications closet name, pull box identifier, cable tray, etc.). Indicate pull rope length on the label.

J. Bushings: The Contractor is solely responsible for ensuring that bushings (insulated throat for metallic conduit, PVC for PVC conduit) are installed at conduit end(s) prior to cable installation. Where cable is installed prior to the installation of bushings, the Contractor shall remove the cable, install the bushing, and re-install the cable at no additional cost to the Owner.

K. Labels: Label each conduit end in a clear manner by designating, at each end of the conduit, the location of the far end of the conduit (i.e. room name, communications closet name, pull box identifier, cable tray, station identifier, etc.). Indicate conduit length on the label.

3.2 INNERDUCTS (SUBDUCTS)

A. Innerduct installation shall strictly comply with manufacturer’s recommendations.
3.3 JUNCTION AND DEVICE BOXES

A. General:

1. Unless otherwise indicated, boxes shall be recessed. Set boxes plumb, level, square and flush with wall. Do not exceed more than 1/16 inch tolerance for each condition. Recess outside edge and trim plates from finished surface in accordance with NEC.

2. Boxes shall be supported independently of the conduit system. Supports shall be noncombustible and corrosion resistant. Suspended boxes shall be supported with threaded rod hangers and galvanized steel clamps, or trapeze hangers such as Unistrut.

3. Box locations may be adjusted by the Engineer by up to 10 feet from the location shown on the Drawings at no additional cost to the Owner.

4. Install additional straps or cross-bracing to ensure a rigid installation in a steel stud system.

5. Boxes on opposite sides of fire rated walls and partitions shall be separated by a horizontal distance of at least 24 inches.

6. Unused knockouts in boxes shall be left sealed.

7. For acoustical purposes, boxes on opposite sides of a wall shall not be located back-to-back.

8. For boxes to be installed in brick, masonry or concrete, offsets shall be provided to provide for proper adjustment to finished surfaces. Exposed mortar is not acceptable around device plates.

9. In the event of discrepancies between box locations shown on the Communications drawings and any other drawings in the Construction Documents, the Contractor shall notify the Engineer and await the Engineer’s direction prior to installation.

B. Device Box Types

1. Device Box:
   
a. Unless specifically noted otherwise on the Drawings, Outlet Boxes shall be dedicated to communications, and shall not be shared with power.

   b. Provide with blank faceplate and pullstring.

2. Outlet Box:

   a. General:

      1) Unless specifically noted otherwise on the Drawings, Outlet Boxes shall be dedicated to Communications Systems, and shall not be shared with power.

      2) The contractor shall install the box and mudring such that the face of the mudring is flush with the face of the wall. Refer to the Architectural Construction Documents (Drawings and Specifications) for Wall Types, Materials and Installation Details.

      3) The use of dividers to divide a single box into “separate” sections for communications and power (or another function) is not acceptable.

   b. Communications Cabling System:
1) Outlet boxes shall be located within 3 feet of an electrical power receptacle. Where conditions are such that this is not possible, promptly notify the Engineer and await the Engineer’s direction prior to rough-in of the box.

c. AudioVisual System:
   1) Refer to drawings and Manufacturers requirements.
   2) Coordinate with AudioVisual contractor prior to rough-in.

3.4 PULL BOXES

A. Install pull boxes in an exposed location, readily accessible both at time of construction and after building occupation. Pull boxes shall not be installed in interstitial or otherwise non-accessible building spaces.

B. If mounting a pull box on ceiling structure above ceiling grid, do not mount higher than 4 feet above grid (mount on wall instead).

C. Install pull boxes such that conduit enters and exits only from opposite ends of the box (i.e. only two sides of a box may be used for conduit entry and those two sides must be opposite one another).

D. Do not install conduits into pullboxes in such a manner as to obstruct the installation of future feeder conduits into or out of the pullbox.

E. A pull box shall not be substituted for a 90 degree bend.

F. Do not exceed one pull box per total conduit run between outlet box and termination point in a communications closet, unless otherwise shown on the Drawings. Where field conditions necessitate the use of additional pull boxes notify the Engineer and await the Engineer's direction prior to procurement and installation.

G. Pull boxes shall be rigidly mounted. Unused knockouts shall be plugged with suitable blanking devices.

H. Labels: Label each pullbox with a unique identifier. Identifiers shall be of the form “RN-YY” where “RN” is the room name of the room closest to (or containing) the pull box, and “YY” is the sequential number of the pull box for each “RN”. For example: The second pull box in the vicinity of room “201” would have the label “201-02”.

3.5 FLOOR BOXES

A. Set boxes plumb, level, square and flush with floor. Do not exceed more than 1/16 inch tolerance for each condition.

B. Floor boxes shall have been tested for use in fire-resistance-rated assemblies applicable to the condition(s) present in Project, and shall be installed in accordance with the instructions included in the listing.

C. For floor boxes installed in concrete slab:
   1. Coordinate floor boxes with slab/concrete topping depth. Where depth of floor box conflicts with slab depth notify the Engineer and await the Engineer's direction prior to procurement and installation.
   2. Adjust box prior to and after concrete pour.
D. Covers shall be installed per manufacturer’s recommendations.

E. For floor boxes with combined power and communications circuits, install metal dividers for separation of circuits and provide separate conduits for power and communications.

END OF SECTION 27 05 33
SECTION 27 10 00

COMMUNICATIONS - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general cabling requirements for the Communications Cabling System.

1.2 RELATED SECTIONS

A. Division 27 Specification Section Common Work - Sleeves, Penetrations and Firestopping. Provide sleeves, penetrations, and firestopping as required to support the work of this Section.

B. Division 27 Specification Section Common Work – Hangers and Supports. Provide hangers and supports as required to support the work of this Section.

1.3 SUBMITTALS

A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section Basic Communications Requirements:

1. Product Data

2. Shop Drawings:

   a. Cable Routing: Provide a cable routing plan if communications cable routing has not been shown on the Drawings, or if the Contractor is proposing a deviation from that shown.

      1) If a routing plan is not required, submit written documentation stating that the routing will be provided as shown on the Drawings, that the Contractor has reviewed the routing shown on the Drawings with the other applicable trades and that all have agreed that it does not create conflicts between the trades, and the routing meets applicable codes, regulations and standards.

      2) If a routing plan is required, submit complete floor plans or detail drawings showing the proposed routing, raceway sizes and locations, and cabling in a manner equal to that of the Drawings. Ensure that any routing changes are coordinated with comparable changes to the raceway routing. Specifically note each location where the proposed routing is different from the Drawings. Where deviations are proposed, submit written documentation detailing the reason for each. Each deviation must be approved in writing by the Engineer prior to proceeding with installation.

   b. Termination Block Wall Field Terminations and Elevations: Provide termination block wall field termination diagrams and elevation drawings where such diagrams and elevations have not been shown on the Drawings, or if the Contractor is proposing a deviation from that shown.

      1) Where changes to the wall field termination diagrams and elevation drawings are proposed, submit wall field termination diagrams and elevation drawings in a manner equal to that of the Drawings. Specifically note areas where deviations are proposed, and submit written documentation detailing the reason for each. Each
deviation must be approved in writing by the Engineer prior to proceeding with installation.

3. Other:
   a. Owner Specific: Submit other information as required by Owner Specific Governing Requirements in Specification Section Basic Communications Requirements.

PART 2 - MATERIALS

2.1 GENERAL

A. Manufacturer: Structured cabling system components shall be sourced by a single Manufacturer or formally partnered Manufacturers (collectively referred to as the “Manufacturer”). Products shall not be intermixed between different manufacturers unless the Manufacturer of the chosen communications cabling system has listed (in writing) another manufacturer’s component as an “approved alternative product” (or equivalent wording) and will warrant the “approved alternative product” as part of the Manufacturer’s extended Warranty, or if the product has been specifically called out as a special requirement in the Specifications. Additionally, for a given Manufacturer, all products shall be part of a single product line and the product line shall be specifically engineered “end-to-end” (e.g. the system and all of its components shall have been engineered to function together as a single, continuous transmission path). The structured cabling system shall be:

1. Copper:
   a. Berk-Tek/Ortronic NetClear Cabling Solution

2. Fiber:
   a. Corning Cable Systems

B. Plenum Rating:

1. Cable shall be permitted to be non-plenum (CM/CMR, OFNR) rated in non-plenum spaces as allowed per local Governing Requirements or code. Cable shall bear non-plenum markings.

2. The Contractor is solely responsible for determining the plenum rating of the environment in which cable is to be installed, and for doing so prior to procurement and installation of the cable. Non-plenum cable installed in an environment determined to be plenum rated shall be removed and replaced by the Contractor at no additional cost to the Owner.

3. All cabling shall bear plenum or non-plenum markings for the environment in which they are installed.

C. Part Numbers: Refer to the Equipment Schedule on the Technology Drawings for specific part numbers. If no part number is provided, then any part meeting the manufacturers and requirements specified is acceptable.

2.2 PERFORMANCE

A. Protocols/Services:

1. At a minimum, the communications cabling system shall support data network protocols/services at rates up to 10 Gbps for transmission on copper, and 10 Gbps for transmission on fiber. It shall
The communications cabling system shall support Ethernet, ATM and other network protocols. The communications cabling system shall additionally support RS-232 and other dedicated point-to-point protocols.

2. The communications cabling system shall support PBX telephone services. It shall support analog, digital, and ISDN services, and shall be compatible with direct trunk lines (POTS).

B. Category Rating: Copper components (cable, connectors, etc.) shall meet or exceed the TIA/EIA transmission requirements for the Category for which they are rated.

1. The horizontal UTP cable shall meet or exceed specifications associated with Category 6A cable as outlined in the ANSI/TIA/EIA 568B.2-1 Category 6A specification.

C. Performance Rating: All components (copper and fiber) shall meet or exceed TIA/EIA transmission requirements for their component type.

D. Fiber Performance:

1. Backbone Cable:
   a. 62.5/125 µm Multimode: Provide extended/high grade cable with a maximum attenuation of 3.5 dB/km at 850 nm and 1.0 dB/km at 1300 nm. The minimum cable bandwidth shall be 200 MHz-km at 850 nm and 500 MHz-km at 1300 nm. Color shall be orange.
   
   b. Hybrid: Provide hybrid cable with the following characteristics:
      1) 50/125 µm Laser Optimized Multimode (OM4): Provide cable with a maximum attenuation of 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm. The minimum cable bandwidth shall be 3500 MHz-km at 850 nm and 500 MHz-km at 1300 nm. Color shall be orange.
      2) Singlemode (OS2): Provide cable with a maximum attenuation of 0.4 dB/km @ 1310 nm, 0.3 dB/km at 1550 nm and 0.4 dB/km at 1383 (uncabled).

PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section Basic Communications Requirements. Governing Requirements of particular relevance to this Section include, but are not limited to:

1. TIA/EIA - 568: Commercial Building Telecommunications Cabling Standard

2. TIA/EIA 569: Commercial Building Standard for Telecommunication Pathways and Spaces

3. ANSI/EIA 310-D: Cabinets, Racks, Panels and Associated Equipment

4. TIA/EIA 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

5. ANSI/NECA/BICSI 607: Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

6. ANSI J-STD-607: Commercial Building Grounding and Bonding Requirements for Telecommunications
7. TIA/EIA - 758: Customer-owned Outside Plant Telecommunications Cabling Standard
8. IEEE 802.3 (series): Local Area Network Ethernet Standards

B. Owner required Governing Requirements of particular relevance to this Section include, but are not limited to:

1. Auraria Cooperative Telecommunications Committee – Universal Cable Plant IT Services –
   Building Infrastructure Distribution Systems Guidelines, Methods and Standards (latest edition)

3.2 GENERAL INSTALLATION

A. Maintain separation from other conductors (power, fire alarm, etc.) per NEC requirements and TIA/EIA standards.

B. The bending radius and pull strength requirements of all cable as detailed in the Governing Requirements and Manufacturers recommendations shall be strictly observed during handling and installation.

C. Pull cables simultaneously where more than one cable is being installed in the same raceway.

D. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation.

E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cable or raceway.

F. Cable jackets shall not be twisted during installation. Cables showing evidence of twisting shall be replaced at no additional cost to the Owner, regardless of the outcome of cable testing.

G. Cable shall be installed in a continuous (non-spliced) manner unless otherwise indicated on the Drawings. Where splicing may be required in areas not shown on the Drawings due to Cable Spool length limitations or otherwise, the Contractor shall obtain the approval of the Engineer prior to procurement and installation.

H. Provide strain relief to ensure durable connections at all cable termination locations.

I. Pathway/Raceway Validation: The Contractor is responsible for validating pathway/raceway sizing against the amount of cable it is to support for compliance with NEC and TIA/EIA 569 cable capacity standards. The Contractor shall notify the Engineer of all raceways the Contractor determines to be insufficient in size and shall await the Engineer’s direction prior to procurement and installation.

J. Copper Cables:
1. Horizontal Cable: Thoroughly clean and remove foreign material from outlet boxes prior to installation of cable.

K. Fiber Cables:
   1. Cables shall be tested on reel prior to installation. Cable which does not pass shall not be installed and shall be replaced at no additional cost to the Owner. “Repairing” cables which do not pass is not acceptable.
   2. All fiber strands shall be terminated. Unless otherwise noted on the Drawings, the installation of unterminated (i.e. “dark fiber”) is not acceptable.
   3. Fiber splices shall be fusion. Mechanical splices are not acceptable. Each fusion splice shall be protected in a splice tray or similar protective device that is designed to mount within the enclosure. Bare/stripped optical fiber strands shall be protected with a buffer tube, heat shrink or silicon adhesive to prevent exposure to moisture.

L. Provide Sleeves and Penetrations as necessary where cable must pass through building barriers such as walls, floors or foundations. Firestop all through and membrane penetrations of fire-rated barriers. Sleeves, Penetrations and Firestopping shall be per the requirements of Division 27 Specification Section Common Work - Sleeves Penetrations and Firestopping.

3.3 CABLE INSTALLED IN RACEWAY

A. In Conduit or Ducts:
   1. Fill ratios shall not exceed NEC requirements.
   2. Cable shall not be pulled into conduit/ducts until the conduit/duct ends have been prepared for cable installation (i.e. ducts cleaned and swabbed, reamed to eliminate sharp edges, bushings installed (insulated throat for metallic conduits, PVC for PVC conduits), etc.). Cables pulled into conduit/ducts prior to conduit/duct end preparation shall be removed and replaced (after the conduit/duct ends are prepared) at no additional cost to the Owner.
   3. Backbone (riser) cables shall not share conduits/ducts with horizontal cables.
   4. Reinstate pull-wires in conduits and ducts after use to facilitate future addition of cables.

3.4 CABLE NOT INSTALLED IN RACEWAY (E.G. “EXPOSED”):

A. There shall be no exposed cable outside of the telecommunications room.

B. Cables shall be strapped, fastened or tie-wrapped for support. Staples are not acceptable.
   1. Straps, fasteners, and tie-wraps shall not be over-tightened. Cables showing evidence of over-tightening shall be replaced at no additional cost to the Owner, regardless of the outcome of cable testing.
   2. Straps, fasteners, and tie-wraps shall be plenum or non-plenum rated to match that of associated cable.
3. Cables shall be loosely grouped by application (horizontal or backbone) and by cable type (Cat 3, Cat 5E, Cat 5, Cat 6, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a grouping.

C. Cable installed on exposed surfaces or structural members shall be installed parallel and perpendicular to the surfaces. Surface contours shall be followed wherever possible. Cables shall be attached to surfaces at intervals not to exceed 3 feet, and the length of spans shall vary along the cable path (i.e. a given span should not be exactly the same length as the span preceding or following it – “exact” spans can degrade cable performance).

D. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable.

E. The quantity of cables installed in j-hooks, straps, and other similar fasteners shall not exceed manufacturer maximum loads for the fastener. Provide additional fasteners as required to meet load and future capacity requirements.

F. Route cable to comply with the Governing Requirements standards and rules for avoiding potential EMI sources of interference and as follows:

1. Provide clearances of:
   a. 6-inches from light fixtures
   b. 12-inches from electrical power distribution (including conduits and cables)
   c. 48-inches from motors and transformers

2. Cable pathway shall cross perpendicular to potential EMI sources of interference.

3.5 CABLE IN COMMUNICATIONS ROOMS AND SPACES

A. Cable on backboards:

1. Lay and dress all cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.

2. Cable shall be routed as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

3. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Secure all similarly routed and similar cables together and attach to D-rings vertically or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

B. Cable Bundles:

1. Cables shall be bundled by application (horizontal or backbone) and by cable type (Cat 3, Cat 5E, Cat 5, Cat 6, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a bundle.

2. Cable bundles shall be combed to present a neat and professional appearance. For performance reasons, combing shall occur from the cable end to a maximum of 35 feet back (or per the...
Manufacturer’s recommendations, whichever is more stringent). For the portion of a cable bundle within the communications room exceeding this requirement (if any), the exterior cables in the cable bundle shall be combed straight. Interior cables shall not be combed (i.e. they shall be left “mixed”).

C. Cable in ladder rack on walls: Place larger cable bundles against wall, smaller cable bundles to the inside.

D. Cable straps: Install cable straps to secure cable bundles to cable runway and other supporting equipment. The use of plastic tie wraps for this purpose is not acceptable. Comply with Division 27 Specification Section Communications - Equipment Room Fittings.

3.6 CABLE SLACK

A. Cable slack in communications rooms and spaces: Store slack by circling cable around communications room in the Cable Runway as shown on the Drawings.

1. Provide Slack length as follows:
   a. Inside Plant Cable: 10 feet minimum for all cable types (horizontal and backbone)

2. Where Cable Runway does not exist or where slack storage is not called out on the Drawings, slack shall be stored as follows:
   a. Copper Cable:
      1) Horizontal: Slack shall be stored in a serpentine loop manner, not in the form of a circular “loop” (for performance reasons).
      2) Backbone: Slack shall be stored in circular “loops”.
   b. Fiber Cable: Slack shall be stored in circular “loops”.

B. Cable slack at the work area outlet: Provide 1 foot of slack. Slack shall be stored in a serpentine loop manner, not in the form of a circular “loop” (for performance reasons).

C. In cases of extreme congestion, notify the Engineer and await the Engineer’s direction prior to installation.

END OF SECTION 27 10 00
SECTION 27 15 00

COMMUNICATIONS - HORIZONTAL CABLEING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes specific requirements for horizontal cable within the Communications Cabling System. General requirements for horizontal cable are covered in Division 27 Specification Section Communications - General Requirements.

1.2 RELATED SECTIONS

A. The requirements of Division 27 Specification Section Communications - General Requirements shall serve as the basis for the requirements of this Section, and are incorporated by reference into this Section.

1.3 SUBMITTALS

A. Comply with the Submittal portion of Division 27 Specification Section Basic Communications Requirements. Provide submittal information for the following:

1. Product Data

PART 2 - MATERIALS

2.1 GENERAL

A. Manufacturer: Unless otherwise indicated, equipment and materials in this Section shall be of the same manufacturer as that specified under Division 27 Specification Section Communications - General Requirements.

B. Part Numbers: Refer to the Equipment Schedule on the Technology Drawings for specific part numbers. If no part number is provided, then any part meeting the manufacturers and requirements specified is acceptable.

2.2 COPPER

A. Horizontal Cable: Cable shall be 4 pair UTP, solid copper conductors insulated with color coded PVC. Copper cable Category rating shall be the same as that specified under Division 27 Specification Section Communications - General Requirements.

1. Provide OSP rated cabling in all “Wet” locations including, but not limited to conduit that is routed underground or exterior to the building.

2. Color shall be:
   a. Voice: white
   b. Data: blue

PART 3 - EXECUTION (NOT USED)
END OF SECTION 27 15 00
SECTION 27 15 43

COMMUNICATIONS - FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for faceplates and connectors within the Communications Cabling System. General requirements for faceplates and connectors are covered in Division 27 Specification Section Communications - General Requirements.

1.2 RELATED SECTIONS

A. The requirements of Division 27 Specification Section Communications - General Requirements shall serve as the basis for the requirements of this Section, and are incorporated by reference into this Section.

1.3 SUBMITTALS

A. Comply with the Submittal portion of Division 27 Specification Section Basic Communications Requirements. Provide submittal information for the following:

1. Product Data

PART 2 - MATERIALS

2.1 GENERAL

A. Manufacturer: Unless otherwise indicated, equipment in this Section shall be of the same Manufacturer as that specified under Division 27 Specification Section Communications - General Requirements.

B. Part Numbers: Refer to the Equipment Schedule on the Technology Drawings for specific part numbers. If no part number is provided, then any part meeting the manufacturers and requirements specified is acceptable.

2.2 FACEPLATES

A. General: Provide faceplates for outlets in the locations and gang counts as shown on the Drawings or as specified below. Faceplates shall be complete with blank inserts/fillers for covering unused connector openings. Faceplates and fittings shall be dimensionally suitable for securely mounting connectors, providing a snug and sure fit – loose connectors are not acceptable. Faceplates shall be complete with port identification labels, and shall be provided with appropriate adapters, fittings and adapters as required.

B. Color: The color of non-stainless steel faceplates shall be gray unless specified below.

C. Faceplates/Fittings:

1. For wall-mount telephone locations:

   a. Faceplates shall be brushed stainless steel with stainless steel mounting lugs suitable for mounting wall-mount telephones. Faceplates shall be dimensionally suitable for securely mounting 8-position/8-conductor IDC (RJ45 style) connectors.
2. For specialized mounting requirements (including but not limited to furniture, furniture “pop-ups” and enclosures, floor-boxes, poke-throughs, surface mounted raceway, etc.):
   a. Provide faceplates and fittings as required to support the specialized mounting. Faceplates and fittings shall be manufactured specifically for the equipment that they are to be mounted into (“general purpose” faceplates field modified for the specialized use are not acceptable unless specifically noted otherwise on the Drawings). Faceplates and fittings shall be approved by both the equipment manufacturer and the communications cabling system manufacturer, and shall be coordinated and verified compatible by the Contractor, equipment manufacturer and cabling system manufacturer prior to procurement and delivery. The provision of the correct faceplates and fittings for use in specialized mounting requirements is the sole responsibility of the Contractor.

3. For walls and other non-specialized locations:
   a. Faceplates shall be plastic.

D. Provide blank faceplates, matching those faceplates in use, for all unused communications backboxes.

2.3 CONNECTORS

A. General: Connectors shall meet or exceed the TIA/EIA standards and as called for in the Governing Requirements.

B. Horizontal:
   1. Copper:
      a. Connectors:
         1) Copper connectors shall be 45-degree angled 8-position/8-conductor, insulation displacement connector (IDC), non-keyed, and shall accept modular 8-position/8-conductor plugs. Connectors shall have a universally color-coded wiring pattern for both T568A and T568B. Copper connectors Category rating shall be the same as that specified under Division 27 Specification Section Communications – General Requirements. Color to match faceplate color. Provide 25 additional connectors as spares to Owner.
      b. Icons:
         a) Provide connector icons as follows:
            1. For voice: yellow icon with telephone symbol
            2. For data: rose-colored icon with computer symbol
         b) Icons shall be specifically manufactured for the faceplate(s) and connectors specified above
         c) Provide 25 additional icons of each color/icon as spares to Owner.

PART 3 - EXECUTION

3.1 FACEPLATES

A. Install all faceplates level and perpendicular to the floor. If long side of existing outlet box is mounted horizontal, then rotate faceplate counter-clockwise.
3.2 CONNECTORS

A. Horizontal:
   1. Copper: Terminate connectors using the T568B wiring pattern at both ends of the cable.

B. Backbone:
   1. Copper:
      a. Comply with Division 27 Specification Section *Communications - Termination Equipment*.

END OF SECTION 27 15 43
SECTION 27 17 10

COMMUNICATIONS - IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for identification/administration of the Communications Cabling System.

1.2 SUBMITTALS

A. Comply with the Submittal portions of Division 27 Specification Sections Basic Communications Requirements and Communications - General Requirements. Provide submittal information for the following:

1. Identification and Administration (see Part 2 – Materials: Identification and Administration herein):

   a. Provide a list of proposed hand-carried or computer software based identification/label makers, and a list of proposed materials for identifiers/labels.

PART 2 - MATERIALS

2.1 IDENTIFICATION AND ADMINISTRATION

A. Identifiers (labels) shall be as recommended in TIA/EIA 606-A, unless noted otherwise herein.

B. Labels shall be permanent (i.e. not subject to fading or erasure) and permanently affixed. Handwritten labels are not acceptable.

C. For identification of materials and equipment interior to the facility:

   1. For cables: Labels shall be created by a hand-carried label maker or an equivalent computer/software-based label making system.

      a. For horizontal cables: Labels shall include a clear vinyl adhesive wrapping applied over the label in order to permanently affix the label to the cable. Using transparent tape to affix labels to cables is not acceptable.

      b. For backbone cables: Labels shall be affixed or engraved on hard plastic markers.

   2. For equipment (racks, frames, cabinets, enclosures, etc.): Provide engraved nameplates.

D. For identification of materials and equipment in the outside plant:

   1. Labels shall be waterproof (even when submerged) and engraved on hard plastic markers. Lettering shall be black, markers shall be white.
PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section Basic Communications Requirements. Governing Requirements of particular relevance to this Section include, but are not limited to:

1. Identification and Administration:
   a. TIA/EIA 606-A: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

2. The Contractor shall pay particular attention to and comply with the following Owner Governing Requirements:

3.2 IDENTIFICATION AND ADMINISTRATION

A. General

1. The Contractor is solely responsible for the completeness, accuracy, and placement of identifiers (labels). Incorrectly identified components are the sole responsibility of the Contractor.
   a. Where questions arise regarding the correct identifier for a given component, the Contractor shall notify the Owner and Engineer and await direction prior to proceeding.

2. The Contractor shall install identifiers where indicated and at locations for best viewing convenience without interfering with the operation and maintenance of equipment.

3. The Contractor shall coordinate names, abbreviations, colors, and other designations with the corresponding designations indicated in the Construction Documents and as required by codes and standards.

4. The Contractor shall use consistent identifiers throughout the Project.

5. The Contractor shall clean surfaces of dust, loose material, and oily films before applying self-adhesive identifiers.

6. Two weeks prior to a particular component or group of components being labeled, the Contractor shall review the proposed identification scheme, label(s), and procedure for affixing label(s) with the Owner and Engineer. Contractor shall not proceed with labeling until the Owner and Engineer have approved the proposed identification scheme, label(s), and procedure for affixing label(s).

7. The Contractor shall physically verify that the component to be identified matches the label to be affixed, prior to affixing the label.

B. Comply with Owner’s Telecommunications labeling standards. Obtain standards from Owner and coordinate labeling scheme with Owner prior to defining, procuring, printing, and installing labels.
C. Outlet References and Labels Spreadsheet

1. An Outlet Reference Spreadsheet shall be created and maintained by the Contractor throughout construction. This spreadsheet shows outlet and patch panel port names, based upon the outlets shown on the Drawings, and is intended for the Owner’s use for patching and cross-connecting purposes during move-in.

   a. The spreadsheet shall be created using the Campus ACTC Naming conventions.

2. The Contractor shall maintain an electronic copy of the spreadsheet with up-to-date as-built information on a minimum two week interval throughout construction.

   a. The Contractor shall provide the Owner or Engineer an electronic copy of the up-to-date spreadsheet upon request during the course of construction.

3. The Contractor shall be solely responsible for the completeness and accuracy of the spreadsheet throughout construction and upon delivery to the Owner and Engineer.

4. Pre-Substantial Completion: Three weeks prior to Substantial Completion, the Contractor shall submit the final version of the spreadsheet to the Owner and Engineer. The final version of the spreadsheet shall incorporate all as-built information and any changes from the original Drawings.

   END OF SECTION 27 17 10
1.1 SUMMARY

A. This Section includes requirements for testing of the Communications Cabling System. Refer to the specific Division 27 Specification Sections for Testing Requirements related to other Communications Systems.

1.2 SUBMITTALS

A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section Basic Communications Requirements:

1. Other:

   a. Testing (see Part 2 – Testing herein):

      1) Provide a list of proposed test equipment for use in verifying the installation of the communications cabling system.

         a) Provide for each testing device:

            1. Manufacturer and product number.

            2. Manufacturer documentation showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the manufacturer’s recommended recalibration period.

            3. Manufacturer documentation showing software revision. Software revision shall be most current revision available for the device and shall be based upon the most current TIA/EIA testing guidelines.

            4. Patch cords and other specialized components.

   b. Provide proposed test result forms.

   c. Provide the calculated optical fiber cable loss budget for each optical fiber cable in the system (see Part 3 – Execution: Testing herein)

PART 2 - MATERIALS

2.1 TESTING

A. General

1. Testing of the systems shall be in accordance with the manufacturer’s recommendations and with the Governing Requirements.

2. Test reports shall be complete and in accordance with the appropriate Governing Requirements.

3. Where testing discloses deficiencies in the work, the Contractor shall rework, repair, or replace equipment and systems found deficient. The Contractor shall continue remedial measures and
retesting until satisfactory results are obtained. Remedial measures and retesting shall be at no additional cost to the Owner.

4. Testing of product or equipment prior to installation shall include performance testing to establish the applicability of equipment for its intended purpose. The Contractor shall:
   a. Establish the required test procedures from required Governing Requirements and manufacturer’s recommendations.
   b. Provide necessary test equipment, power, and consumables to perform the test.
   c. Notify the Engineer of test schedule(s) at least one week in advance.
   d. Perform test.
   e. Provide test result documentation to the Engineer.

5. Final testing and start-up of product, equipment, and systems shall include establishing proper capacity, operation, maintenance, and compliance with Governing Requirements. The Contractor shall:
   a. Provide the services of manufacturer’s representatives for systems to be tested and started up.
   b. Establish the required test procedures from required Governing Requirements and manufacturer’s recommendations.
   c. Provide necessary test equipment, power, and consumables to perform the test.
   d. Notify the Engineer of test schedule(s) at least one week in advance.
   e. Perform tests and start-up functions.
   f. Provide documentation of test results and fully operational systems to the Engineer.

6. Test records shall be provided on a form approved by the Engineer.

B. Systems Specific: Test shall be performed for each of the following systems as follows:

1. Communications Cabling System
   a. Test records:
      1) Each cable in the system shall be tested. Test result forms shall include the cable identifier, tests performed, outcome of tests and indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Test result forms shall be provided to the Owner and Engineer for review and acceptance.
      2) Test records for each cable within the system shall be printed directly from the tester and shall be submitted in paper form (in a binder) and on compact disk to the Owner and Engineer for review. Handwritten test results will not be accepted.
   b. Testing Devices: Testing devices shall be capable of storing and printing test records for each cable within the system.
      1) For copper cables:
a) Testing device shall be a TIA/EIA TSB-95 Level 3 testing instrument re-calibrated within the calibration period recommended by the manufacturer, with the most current software revision based upon the most current TIA/EIA testing guidelines.

2) For fiber cables:
   a) Testing devices shall consist of a light source/power meter with a stabilized light source for end-to-end attenuation testing and an Optical Time Domain Reflectometer (OTDR) for testing on the reel, for continuity and quality testing, for accurately determining cable length, and for locating and correcting problems noted during attenuation testing. Testing equipment shall be calibrated and traceable to the National Institute for Standards and Technologies (NIST), with an operating range of 850 +/- 30 nm or 1300 +/- 20 nm for multimode testing in accordance with TIA/EIA-526-14 for multimode testing, and an operating range of 1310 +/- 10nm or 1550 +/- 20 nm in accordance with TIA/EIA-526-7 for singlemode testing.
   b) To ensure quality connectorization, a microscope of not less the 200x magnification shall be used to visually inspect connectors and splices after installation.

PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section Basic Communications Requirements. Governing Requirements of particular relevance to this Section include, but are not limited to:

   1. Testing:
      a. TIA/EIA - 455: Fiber Optic Test Standards
      b. TIA/EIA - 526: Optical Fiber Systems Test Procedures
      c. TIA/EIA - 568 Commercial Building Telecommunications Cabling Standard
      d. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard

B. The Contractor shall pay particular attention to and comply with the following Owner Governing Requirements:


3.2 TESTING

A. General

   1. Test devices shall be in calibration throughout the testing period. Tests performed on equipment without up to date calibration shall be rejected and shall be repeated at no additional cost to the Owner.
2. The Contractor shall notify the Engineer and Owner at least one week in advance of each type of test to be conducted. The Owner or Engineer may, at their discretion, witness all testing.

   a. The Owner and Engineer shall be invited to attend and inspect the first instance of each type of test to be conducted. Tests conducted prior to first inspection shall be at the sole risk of the Contractor, and as such are subject to rejection. Such tests will be repeated at no additional cost to the Owner.

B. Systems Specific Testing:

1. Communications Cabling System

   a. All interior (inside plant) and exterior (outside plant) fiber cables shall be tested on the reel upon delivery to the job site prior to installation.

      1) Test results shall be permanently affixed to the reel and a copy given to the Owner and Engineer for review prior to installation.

      2) Testing shall demonstrate compliance with the factory test results as shipped with the reel. Cables that fail to pass shall not be installed, and the Contractor shall replace the cable at no additional cost to the Owner. Repair of damaged cable is not acceptable.

   b. Test the communications cabling system for compliance to the Governing Requirements and all applicable standards as follows:

      1) Visually inspect all labels at the outlet locations (faceplates/ports), patch panels/ports, and on each end of each cable to ensure that all cables and equipment are correctly identified.

      2) Copper Cable:

         a) For Horizontal Distribution: Test each copper horizontal cable, all pairs. To the extent possible, tests shall be performed with building electrical systems fully powered on (i.e. Lights, HVAC, etc.).

            1. Test each end-to-end Permanent Link (the entire link from the connector at the outlet to the connector or termination in the telecommunications closet) utilizing sweep tests, for Wire map (continuity), length, propagation delay/delay skew, attenuation (insertion loss), return loss, near-end cross talk (NEXT) loss, Equal Level Far-End Crosstalk (ELFEXT), attenuation-to-crosstalk ratio (ACR), power sum NEXT (PSNEXT) and power sum ELFEXT (PSELFEXT). Each cable shall be tested in both directions.

            2. Test results shall demonstrate compliance with:

               (i) The criteria specified in TIA/EIA 568 for Category 6 cables

               (ii) The criteria specified in TIA/EIA TSB 95, and TIA/EIA 568-A-5

               (iii) The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)

         b) For Backbone Distribution (inside and outside plant): Test each cable, all pairs, for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the presence of AC voltage.

            1. Test entire channel, from termination block to termination block.
2. Test results shall demonstrate compliance with:
   
   (i) The criteria specified in TIA/EIA 568 for Category 3 cables

3) Fiber Cable:
   
a) Prior to testing, the cable loss budget shall be calculated by the Contractor for each optical fiber cable and shall be clearly shown on the test documentation. Maximum loss shall be calculated by the following formula, assuming no splices:

   1. For Horizontal Distribution:
      
      (i) Max Loss = 2.0db (per TIA/EIA 568A Annex H)

   2. For Backbone Distribution (inside and outside plant):
      
      (i) Max Loss = (allowable loss/km) * (km of fiber) + (0.4db) * (# of connectors)

      (ii) A mated connector-to-connector interface is defined as a single connector for the purposes of the above formula.

   3. A given fiber cable shall not exceed its calculated maximum loss (per the above formula).

   b) Test all strands. Testing shall consist of a bi-directional end-to-end Optical Transmission Loss Test Instrument trace performed per TIA/EIA 455-61 and a bi-directional end-to-end power meter test performed per TIA/EIA 455-53A.

      1. Loss numbers shall be calculated by taking the sum of the two bi-directional measurements and dividing that sum by two.

      2. All backbone fiber cables shall be tested with an OTDR in addition to attenuation testing performed with a power meter.

      (i) The number of samples (averages) for each OTDR test shall be such that the noise amplitude is significantly less than the smallest loss of any component under test.

   3. Multimode fiber testing shall incorporate use of a mandrel wrap of fiber jumper to induce macro bends in the fiber.

   c) Test measurements shall be provided as follows:

      1. For Multimode Cable: Test at both 850 and 1300nm.

      2. For Singlemode Cable: Test at both 1300 and 1550nm.

   d) Test results shall demonstrate compliance with:

      1. The criteria specified in TIA/EIA-568A Annex H.

      2. The Contractor’s calculated loss budget above.

      3. The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)

   c. In addition to the above, tests performed shall be both those recommended and mandated by the communications cabling system Manufacturer.

   d. Cables and equipment that do not pass shall be identified to the Engineer. The source of the non-compliance shall be determined, corrected or replaced, and re-tested at no additional cost to the Owner. Provide new test results to the Engineer in the same manner as above.
1) In addition to the above, if it is determined that a cable is at fault, the contractor shall remove the damaged cable and replace it with a new cable. Cable “repairs” are not acceptable. The procedure for removing the cable shall be as follows:

   a) Prior to removal of the damaged cable and re-pull of the new cable:
      1. Any cables which are in the same conduit, duct or innerduct as the damaged cable shall be tested, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
      2. If the damaged cable is a backbone or outside plant cable:
         (i) The Owner and Engineer shall be informed of the schedule for the removal and re-pull.
         (ii) The new cable shall be tested on the reel prior to installation.
      3. All test results shall be provided to the Engineer for approval.
   b) The damaged cable shall be removed and the new cable shall be pulled in.
   c) After the removal of the damaged cable and re-pull of the new cable:
      1. The new cable shall be tested.
      2. Any cables which are in the same conduit, duct or innerduct as the damaged cable shall be tested, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
      3. All test results shall be provided to the Engineer for approval.
   d) Existing cables which are in the same conduit, duct or innerduct as the damaged cable, and which are damaged by the extraction and re-pull process, shall be removed and replaced at no additional cost to the Owner.
      1. Existing damaged cables that are replaced shall be subject to the testing procedures of this Section in its entirety.

END OF SECTION 27 17 20
SECTION 27 40 00

AUDIOVISUAL - GENERAL REQUIREMENTS

PART 1  - GENERAL

1.1  SUMMARY

A. This Section provides supplemental information to Division 27 Specification Section Basic Communications Requirements.

B. Provide all labor, materials, equipment, tools and services required for the installation of conduit, boxes and related pathways (rough in) for the Audiovisual Systems.

1.2  RELATED SECTIONS

A. Division 27 Specification Section Common Work - Sleeves, Penetrations and Firestopping. Provide sleeves, penetrations, and firestopping as required to support the work of this Section.

B. Division 27 Specification Section Common Work – Hangers and Supports. Provide hangers and supports as required to support the work of this Section.

C. Division 27 Specification Section Communications – Horizontal Cabling. Provide cabling as required to support the work of this Section.

D. Division 27 Specification Section Communications – Faceplates and Connectors. Provide faceplates as required to support the work of this Section.

1.3  SUBMITTALS

A. Provide the following per the criteria set forth for Submittals in Division 27 Specification Section Basic Communications Requirements:

   1. Product Data

   2. Shop Drawings

1.4  RECORD DOCUMENTS

A. Provide Record Documents per the criteria set forth for Record Documents in Division 27 Specification Section Basic Communications Requirements.

1.5  OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance Manuals per the criteria set forth for Operation and Maintenance Manuals in Division 27 Specification Section Basic Communications Requirements.
PART 2 - MATERIALS

2.1 GENERAL

A. Plenum Rating:

1. Cable shall be permitted to be non-plenum rated in non-plenum spaces as allowed per local Governing Requirements or code. Cable shall bear non-plenum markings.

2. The Contractor is solely responsible for determining the plenum rating of the environment in which cable is to be installed, and for doing so prior to procurement and installation of the cable. Non-plenum cable installed in an environment determined to be plenum rated shall be removed and replaced by the Contractor at no additional cost to the Owner.

3. Supports, incidental materials, cable ties and cable retainers shall be plenum or non-plenum rated to match that of associated cable.

PART 3 - EXECUTION

3.1 GENERAL

A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section Basic Communications Requirements. Governing Requirements of particular relevance to this Section include, but are not limited to:

1. IEEE C62.41: Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

2. UL 1449: Transient Voltage Surge Suppressors

3.2 SOFTWARE IMPLEMENTATION

A. The Contractor shall provide all software implementation as required to provide a fully functional and operating system ready for the Owner’s use. Software implementation shall include but not be limited to programming, configuration, modification, integration of other systems, integration of exist systems, data entry and installation. Existing Audiovisual Systems shall be incorporated into new/expansion systems, as required.

B. The Control System shall provide a seamless control process to unify the Audiovisual System. This system shall consist of but not limited to a programmable control processor capable of multiple control protocols and a touch sensitive type control interface panels. The Control System shall provide full operation of the Video System, the Video Conferencing System, the Sound Reinforcement System, Lighting Control System (by others) and motorized window shades (by others).

C. The Contractor shall coordinate with the Owner and the Engineer for the Control System operation and functionality requirements. The Contractor shall schedule a minimum of 2 Control System design meetings in which the Owner and/or Engineer shall be in attendance. These meetings shall establish the basis of the Control System programming requirements. The Control System design meetings shall be scheduled in a time manner as to not delay the completion of the Audiovisual System. Items to coordinate shall include but not be limited to:

1. Control interface panel appearance

2. Control interface panel operation and functionality
3. Control System synchronized operations of multiple devices

D. Network control features:
   1. The control system shall be available over the network via a web server. The web based control page shall have all the same control features as that available at the physical control interface.

   2. The control system shall be managed via the network utilizing a newly provided and configured Room View Resource Management Suite.

E. Event scheduling features:
   1. The control system shall provide event scheduling for the audiovisual system. Coordinate operation and event times with owner.

   2. Event scheduling shall include but not be limited to:
      a. Audiovisual System power-on
      b. Audiovisual System power-off

F. The Contractor shall demonstrate the Control System functionality to the Owner prior to acceptance testing for evaluation. Any modifications required by the Owner shall be incorporated into the Control System prior to Acceptance Testing.

3.3 HARDWARE CONFIGURATION

A. The Contractor shall provide all hardware configurations as required to provide a fully functional and operating system ready for the Owner’s use. Hardware configuration shall include but not be limited to firmware configuration, data communication, system settings, power distribution and installation. Existing Audiovisual Systems shall be incorporated into new/expansion systems, as required.

B. The Contractor shall closely coordinate with the Owner to ensure that Owner provided equipment is procured, configured (as necessary), and installed (as necessary) with ample lead time prior to the Contractor’s use of the equipment.

3.4 INSTALLATION

A. Pathways: Prior to installation of Audiovisual cabling, Contractor shall verify conduit sizing and quantity for correctness. Deviations from design documents shall be documented and Contractor shall contact Engineer with notification of deviation.

B. Cabling:
   1. Circuits shall be physically separated by metal raceway or by a minimum distance of six inches when metal raceway is not applicable. Circuit separation shall be based upon signal level:
      a. Audio circuits -20dBm or less – Microphone signal
      b. Audio circuits -20dBm thru +20dBm - Line level audio
      c. Audio circuits +20 or above – Loudspeaker signal
      d. Video circuits: 1 volt
2. Cable pulls shall be conducted within the following requirements:
   a. Manufacturer’s guidelines for pulling tension and bend radii.
   b. Circuit separation.
   c. NEC conduit fill standards. The Contractor shall notify Engineer prior to cable installation when the conduits are found to be undersized.
   d. Any cable found to be faulty due to poor cable pull practices shall be removed and replaced at no additional cost to Owner.

3. Cable splicing shall not be considered a common installation practice. If necessary, splice cables only in junction boxes or racks. Shielded cables shall not be spliced; instead each end shall be terminated with an appropriate connector to maintain shield continuity. Any cable found to be faulty due to splicing shall be removed and replaced at no additional cost to Owner.

4. The Contractor shall dress all cables at both ends with:
   a. Black heat shrink where jacketing has been stripped away to expose the individual conductors
   b. Clear heat shrink around the exposed shield conductor (Coax excluded)
   c. Printed, adhesive labels with clear heat shrink over each label

5. Contractor shall make all terminations with rosin-core solder, crimp/compression type connectors or captive screw type mechanical connections. For captive screw type mechanical connection, use spade type or ferrule type crimp connections. Bare wire terminations are not acceptable.

C. Equipment:

1. Equipment shall be installed as indicated and specified, and in accordance with the manufacture’s recommendations, except where local codes or regulations take precedence.

2. Place equipment labels or other identification where the label or identification can be easily seen and read without difficulty.

3. Equipment shall be installed level, plumb, parallel, and perpendicular to building structures and to other building systems and components, except where otherwise indicated.

4. Equipment shall be securely fastened. Select fasteners and supports so that the load applied to any one fastener maintains a minimum load factor of five.

5. Equipment locations: Prior to installation of Audiovisual equipment, Contractor shall coordinate with other trades and subsequently verify all equipment locations that mount on walls or within ceilings. This shall include but not be limited to:
   a. Structural elements such as lighting devices, HVAC equipment, fire protection devices, and cable tray
b. Structural support elements for ceiling mounted devices

c. Backing Board for wall mounted devices

6. Prior to head-end equipment installation, contractor shall verify equipment rooms are free of airborne contaminants.

7. After head-end equipment installation, contractor shall protect equipment from any future construction work that could cause damage to equipment, i.e. masonry, wood, paint, plumbing, etc.

8. Prior to furniture work, Contractor shall coordinate with other trades and subsequently verify all equipment locations that mount within furniture.

9. Contractor shall coordinate with architect as to any equipment color and finish requirements.

D. Grounding:

1. Contractor shall follow accepted engineering practices when installing the Audiovisual grounding system. The Audiovisual grounding system installation shall conform to NEC. The Contractor shall be responsible for correcting any signal grounding problems within the Audiovisual system (not Division 16 grounds) including but not limited to electromagnetic/electrostatic hums, ground loop anomalies, and distortions.

2. A grounding buss bar shall be installed in each equipment rack. The copper buss bar shall be sized to accommodate all connections plus future expansion.

   a. An insulated copper conductor properly sized shall bond the equipment rack buss bar to the dedicated ground conductor provided by Division 16.

   b. A “Star Type” grounding network shall be established within the equipment rack. All Audiovisual components shall be grounded to this buss bar. Ground all components according to the following methods:

      1) Equipment having a power cord without a grounding conductor connected to chassis: furnish and install 14 AWG grounding conductor from component’s metallic chassis to grounding buss bar within rack.

      2) Equipment having a power cord with grounding conductor connected to chassis: do not install an additional grounding conductor.

      3) Physically isolate all rack mounted equipment from racks with isolation washers.

3. Shielded audio signal cables shall have the shields terminated at one end only. The non-terminated shield conductor shall be trimmed to a length of 1/4 inch, folded back against the cable jacketing and covered with black heat shrink.

4. All ungrounded equipment, such as microphones, shall have the shielding terminated at both ends with only one end connected to ground.

5. All Video and Data shielded cables shall have the shielded conductors terminated on both ends.

E. Structural Installations

1. Structural support elements:
a. Structural support elements are defined as those materials added to structure for the reinforcement of general construction methods to meet a designed minimum load factor of five. These include but are not limited to:
   1) Backing boards required for the support of Audiovisual equipment or cabling
   2) Strut supports hung from structural beams or concrete slab

b. It is the Electrical Contractor’s responsibility to provide structural support elements for the Audiovisual equipment.

c. The Contractor shall provide all Audiovisual mounting and rigging equipment that fasten to the structural support elements.

d. All support elements and fastenings shall be able to support a minimum load factor of five times the total assembled weight.

e. The Contractor shall be responsible for the complete and correct installation of all the Audiovisual equipment.

2. Loudspeaker Locations:

a. Contractor shall provide safety cables at all loudspeaker locations. All safety cable elements and fastenings shall be able to support a minimum load factor of five times the total assembled weight. Safety cables shall be affixed to structure elements other than that of the primary mounting method.

b. Loudspeaker installation requirement shall be coordinated prior to conduit installation. The Contractor is responsibility for all coordination of loudspeaker installation requirements with other trades. The Contractor is responsible for structural support work of other trades. If structural support installation is deemed inadequate in the opinion of the Architect, Owner and/or Engineer, the Contractor shall be responsible for all corrective measures to structural support elements.

c. Loudspeaker locations including but not limited to hard ceiling and in wall installations requiring trim rings, rough-in brackets and/or loudspeaker back boxes shall be installed during conduit installation. The Contractor shall install the trim rings, rough-in brackets and back boxes for loudspeaker locations in a timely manner, not to conflict with scheduled work of other trades. In the event that this equipment is not installed in a timely manner, the Contractor shall be responsible for all retrofit work and materials to provide a full functioning speaker assembly.

F. POWER DISTRIBUTION

1. The Audio Visual Contractor shall provide all power distribution equipment required to provide a fully functional and operating system ready for the Owner’s use. Power distribution equipment shall include but not be limited to; power conditioners, surge suppressors, power supplies, power strips, power cords and power cabling.

2. Power distribution equipment may or may not be indicated in drawings and/or specifications.

3. Power distribution equipment indicated within drawings and/or specifications are shown for specific implementation, isolation from other uses, or general clarification.
4. Power distribution equipment shown within drawings and/or specifications does not represent the power distribution equipment in its entirety, the Contractor shall provide remaining power equipment as required to provide a fully functional and operating system for the Owner’s use.

G. WIRE AND CABLES

1. This equipment shall as a minimum conform to the following specifications. Cable conductor and gauge requirements may vary depending on device requirements. Contractor to determine and utilize cables with proper conductor and gauge requirements to provide optimum operation of system devices.

2. All HDMI cables are to have locking connectors

3. Communication Cable: This cable shall conform to Division 27 Specification Section - Communication Horizontal Cabling.

4. Composite Video: This cable distances less than 100 feet shall be a Shielded/Coaxial one 20 AWG solid conductor, 75 ohm.

5. Composite Video: This cable distances more than 100 feet shall be a Shielded/Coaxial one 18 AWG solid conductor, 75 ohm.

6. Contact Closure: This cable shall be an Unshielded Twisted Non-Pair, (2) 20 AWG stranded conductor.

7. Control System Data: This cable shall be a Shielded Twisted Pair, (2) 18 AWG stranded conductor and a Shielded Twisted Pair, (2) 18 AWG stranded conductor.

8. Fiber: This cable shall be a Multi Mode conductor.

9. Infrared: This cable shall be a Shielded Twisted Pair, (2) 22 AWG stranded conductor.

10. Line Audio: This cable shall be a Shielded/Twisted/Pair, two 22 AWG stranded conductor.

11. Loudspeaker Audio (25/70/100 volt Distributive): This cable shall be an Unshielded/Twisted/Pair, two 16 AWG stranded conductor.

12. Loudspeaker Audio (Ohm): This cable shall be an Unshielded/Twisted/Pair, two 12 AWG stranded conductor.

13. Microphone Audio: This cable shall be a Shielded/Twisted/Pair, two 22 AWG stranded conductor.

14. Power supply: This cable shall be a Shielded Twisted Pair, Unshielded Twisted Non-Pair, (2) 18 AWG stranded conductor.

15. DigitalMedia: This cable shall be Crestron twisted Pair specific to DM applications in order to preserve Crestron’s warrantee.

16. Radio Frequency: This cable shall be a Shielded Coaxial, (1) 20 AWG solid conductor, 50 ohm.

17. RGBHV Video: This cable shall be a Shielded/ (5 individual coaxial conductors), one 26 AWG stranded conductor, 75 ohm.

18. RS-232 Data: This cable shall be a Shielded/Twisted/Pair, two 24 AWG stranded conductor.
19. RS-422 Data: This cable shall be a Shielded Twisted Pair, (4) 24 AWG stranded conductor.

20. RS-485 Data: This cable shall be a Shielded/Twisted/Pair, four 24 AWG stranded conductor.

H. Manufacturer: Unless otherwise indicated, equipment in this Section shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. All components used in the system shall be commercial designs that comply with the Specifications. Each major component of equipment shall identify the manufacturer’s name, model and serial number. Items of the same classification shall be identical. This includes equipment, modules, parts, and components. The Engineer retains the right to reject products which reflect, in the Engineer’s opinion, sub-standard design practices, manufacturing procedures, support services, or warranty policies.

1. Unless otherwise indicated, the equipment by the following manufacturers shall not be substituted. The Contractor shall provide the most current model and/or version of product available by listed manufacturer at time of procurement:

   a. Crestron

I. Equipment Schedule(s): The equipment schedule(s) within the drawings is general in nature and is provided to define system requirements, including but not limited to: functionality, signal compatibility, mounting requirements, space requirements, cooling requirements and overall clarity / intent of operation. The equipment schedule is not all inclusive and is not to be used as a bill of materials. The Contractor shall provide all equipment required for a fully functional and operating system ready for the Owner’s use that may or may not be explicitly specified within Construction Documents.

J. Part Numbers: Refer to the equipment schedule(s) for specific part numbers. Part numbers listed in the equipment schedule(s) define the performance specifications for the parts and shall be per the most recent manufacturer’s cut/data specification sheets available at the time of bid. If no part number is provided, then any part meeting the functional and operational requirements specified is acceptable.

K. Substitutions base on availability: Unavailable equipment shall be replaced with like make and model of equal or greater capabilities. Substitutions shall be submitted to engineer for approve prior to procurement. Equipment substitutions shall be considered if equipment has been discontinued by manufacturer, recalled by manufacturer, technologically obsolete, manufacturer lead times exceed project milestones and/or manufacturer has ceased business practices within the continental United States of America.

L. Provide materials in quantities as required to provide a fully functional and operational System.

M. Owner Provided Contractor Installed: Equipment identified with an “OFCI” shall be provided by Owner for the Contractor to install.

3.5 TESTING

A. Performance Standards

1. Audio

   a. Electrical Requirements

      1) Frequency response: 20 Hz - 20KHz at ±1.0 dB
      2) Total harmonic distortion + noise: 20 Hz - 20KHz at ±1.0 percent dB
      3) Signal to noise ratio with crosstalk: minimum 55dB at 20 Hz – 20 KHz
b. Acoustical Requirements
   1) Sound pressure levels shall evenly cover the audience area without audible distortions, hums, noise, rattles or buzzes.
      a) Nominal program material: 85 dB at ±2.0 dB with a minimum of 10 dB above ambient noise.
      b) Nominal speech material: 85 dB at ±2.0 dB with a minimum of 10 dB above ambient noise.
      c) Maximum sound pressure level: 100 dB at ±2.0 dB
      d) Contractor shall make final loudspeaker sound pressure level adjustments according to Owner’s recommendations determined during acceptance testing.
   2) Frequency Response:
      a) Speech reinforcement: uniform response from 125 Hz – 2 KHz at ± 2 dB. Below 125Hz, roll off 6 dB/octave. Above 2 KHz, roll off 3 dB/octave.
      b) Program reinforcement: uniform response from 63Hz – 2.5 KHz ± 2 dB. Below 63 Hz, roll off appropriate to loudspeaker specification. Above 2.5 KHz, roll off 3 dB/octave.

2. Video
   a. Electrical Requirements
      1) Signal strength: minimum 70 I.R.E. with 100 percent SMPTE white reference level.
      2) Signal to noise ratio: minimum 55dB at 0 Hz - 4.2 MHz
      3) Crosstalk: minimum 45dB at 0 Hz - 4.2 MHz
      4) Frequency response: ±0.5 dB at 0 Hz - 4.2 MHz
      5) Line and field tilt: 2 percent maximum
      6) Differential gain: 3 percent maximum
      7) Differential phase: 2 degrees maximum
      8) Sync: 50 microseconds maximum
   b. Optical
      1) The projection system including projection screen, projector and mirrors shall be securely installed. No physical movement or vibration in projection system shall be acceptable.
      2) Projector light levels: ±15 percent output in lumens of projector specifications
      3) Projector light coverage: ±20 percent uniform light coverage within all areas of projection screen.

B. Operational Testing
   1. Prior to system training and acceptance testing, the Contractor shall perform and document operational testing.
   2. Contractor shall assemble the following test equipment:
a. Ground fault indicator

b. Digital Multi-meter

c. Load resistors:
   1) Microphone load: 150 ohm, shielded, terminating resistors
   2) Line load: 600 ohm, shielded, terminating resistors
   3) Loudspeaker load: varies, match impedance measurements within 10 percent

d. Sine Wave Generator:
   1) Continuously variable from 20Hz – 20kHz with level accuracy of 0.5dBu
   2) Level Range: -35 dBu to 26 dBu.
   3) Total Harmonic Distortion: 0.01 percent

e. Pink Noise Generator
   1) Noise frequency: 20Hz – 20kHz, 1/3 octave band filtered
   2) Level Range: -35 dBu to 26 dBu.
   3) Total Harmonic Distortion: 0.01 percent

f. Sound level meter meeting ANSI S1.4 specifications

g. Polarity tester

h. Impedance meter: Accuracy, 1 ohm – 8000 ohms, ±10 percent, 20Hz – 20kHz

i. Oscilloscope: minimum of 20 MHZ bandwidth

j. Real-time spectrum or fast fourier transform analyzer:
   1) Filters: ANSI compliant with 1/3 octave band filtering
   2) Frequency range: 20Hz to 22Khz
   3) Frequency accuracy: ± 0.5 dB, 20 Hz to 22kHz
   4) Level range: 25 dB to 140 dB
   5) Level accuracy: ± 0.1 dB

k. Distortion analyzer: THD minimum 0.02 percent with accuracy of 5 percent of reading.

l. Video generator: SMPTE color bar, multi-burst, and full white patterns

m. Light meter: measurements in foot-candles and lux. Accuracy: 3 percent.

n. Waveform monitor

o. Vectorscope

3. Nominal test signals:

a. Level
1) Microphone level: -50dBu
2) Unbalanced line level: -10dBV
3) Balanced line level: +4dBu

b. Frequency:
   1) Full-range frequency loudspeaker networks: 1000Hz sine wave
   2) Crossover loudspeaker networks: apply a sine wave with a frequency centered within the frequency band of the signal path under test.

4. Field Measurements:
   a. Prior to any connections being made to building power, Contractor shall use a ground fault indicator to verify the circuits provided have proper ground wiring. Notify Owner upon discovery of any faulty wiring. In no way is Contractor to perform any work on any faulty electrical wiring discovered.
   b. Contractor shall produce a checklist for the testing and documentation of all Audiovisual equipment. Each device shall be verified for proper operation.
   c. Contractor shall correct any defects upon discovery. Contractor shall notify and coordinate with other trades to ensure all defects (including those by other trades that affect the Audiovisual system) are corrected and put into working order.
   d. Impedance testing: Measure and document impedance level of each loudspeaker cable entering equipment rack.
      1) Full-range frequency networks: measure impedance at 1000Hz.
      2) Crossover networks: measure impedance at center frequency for frequency band of loudspeaker network under test.

5. Audio System Measurements
   a. The following procedures are the minimum requirements for this testing section. These procedures are guidelines only; refer to listed reference material for testing criteria. Manufacturer’s recommendations for operation and connectivity of specific test equipment shall be observed for all testing procedures. Perform all applicable procedures and document results.
   b. Hum and noise testing: verify system is free of any hums, noises, buzzes, oscillations, or any other anomalies contributing to poor system operation. Correct any defects upon discovery.
   c. System Gain Structure
      1) The system gain structure shall be configured in such a way as to maximize dynamic range and provide a uniform clipping level across the entire audio system.
         a) References:
2) Contractor shall incorporate signal attenuation and gain devices as necessary to achieve proper system gain structure.

3) Procedure:
   a) Set signal path gains to a minimum while still passing signal.
   b) Set signal path processing equipment except bandpass filters to bypass.
   c) Set signal path volume attenuators to minimum attenuation.
   d) Connect a signal generator to the input of the signal path under test. Set the signal generator to a nominal frequency and level for the signal path under test. Set the input gain stage of the signal path under test to a nominal operating level (0 dB VU or -18 dBFS).
   e) Connect an oscilloscope to the final output of the signal path under test. Terminate the output with a load resistor appropriate for the signal path under test.
   f) Adjust the signal generator level to a maximum level just below clipping as measured on the oscilloscope.
   g) Set all gain stages in the signal path to a maximum level just below clipping as measured on the oscilloscope.
   h) Perform this procedure for all signal paths in the audio system.

4) Documentation:
   a) Document the final level of the signal path under test as measured on the oscilloscope for the signal path’s final settings.
   b) Document the signal generator’s output level.

d. Amplifier Gain Structure

1) The amplifier gain structure shall be configured in such a way as to provide full amplifier gain at a maximum system input signal level just before clipping.
   a) References:

2) Procedure:
   a) Set signal path processing equipment except bandpass filters to bypass.
   b) Set signal path volume attenuators to minimum attenuation.
   c) Set the amplifier input attenuator of signal path under test to maximum attenuation.
   d) Connect a pink noise generator to the input of the signal path under test. Set the signal generator to a maximum system signal level just before clipping for the signal path under test.
   e) Terminate the loudspeaker network to the amplifier output of the signal path under test.
   f) Position a sound pressure level meter measurement microphone on-axis with the loudspeaker under test.
g) Adjust the amplifier input attenuation of the loudspeaker network under test until one of the following conditions is reached:

1. Amplifier maximum output level: the point at which the amplifier output signal begins to clip. Increase the amplifier input attenuation to achieve an output level just below signal clipping.

2. Loudspeaker maximum sound pressure level: the point at which further decrease of input attenuation has negligible effect upon the loudspeaker’s sound pressure levels. Increase the amplifier input attenuation to achieve the loudspeaker’s maximum sound pressure level.

3. Acoustic maximum sound pressure level: the point at which the loudspeaker sound pressure level measures the specified maximum sound pressure level as defined in the performance standards.

3) Documentation:
   a) Document the amplifier input attenuation settings for the signal path under test.
   b) Document the sound pressure level of the loudspeaker under test.

e. Signal to Noise
   1) The signal to noise testing shall be conducted to determine the amount of noise present in the audio system referenced to a nominal operating input signal.
      a) References:
         2. Dennis Bohn, RaneNote 145, Audio Specification (Rane Corporation, Mukileto, WA).

   2) Procedure:
      a) Set signal path processing equipment except bandpass filters to bypass.
      b) Set signal path volume attenuators to minimum attenuation.
      c) Connect a volt meter to the output of the signal path under test. Terminate the output with a load resistor appropriate for the signal path under test.
      d) Connect a signal generator to the input of the signal path under test. Set the signal generator to a nominal frequency and level for the signal path under test.
      e) Replace signal generator with load resistor appropriate for signal path under test.

   3) Documentation:
      a) Document the level as measured on the volt meter with the signal generator connected to the input of signal path under test.
      b) Document the level as measured on the volt meter with a load resistor connected to input of the signal path under test.

f. Frequency Response
1) The frequency response testing shall be conducted to determine the bandwidth of the audio system.
   a) References:
      2. Dennis Bohn, RaneNote 145, Audio Specification (Rane Corporation, Mukileto, WA).

2) Procedure:
   a) Set signal path processing equipment except bandpass filters to bypass.
   b) Set signal path volume attenuators to minimum attenuation.
   c) Connect a signal generator to the input of the signal path under test. Set the signal generator to a nominal frequency and level for the signal path under test.
   d) Connect a volt meter to the output of the signal path under test. Terminate the output with a load resistor appropriate for the signal path under test. Calibrate the volt meter to 0 volts.
   e) Sweep the signal generator frequency from 20Hz to 20kHz.
   f) Perform this procedure for all signal paths in the audio system.

3) Documentation:
   a) Document all frequencies that deviate from the performance standards.

G. Total Harmonic Distortion + Noise

1) The total harmonic distortion testing shall be conducted to determine the linearity of the audio system.
   a) References:
      2. Dennis Bohn, RaneNote 145, Audio Specification (Rane Corporation, Mukileto, WA).

2) Procedure:
   a) Set signal path processing equipment except bandpass filters to bypass.
   b) Set signal path volume attenuators to minimum attenuation.
   c) Connect an oscilloscope to the output of the signal path under test. Terminate the output with a load resistor appropriate for signal path under test.
   d) Connect a signal generator to the input of the signal path under test. Set the signal generator to a nominal frequency for the signal path under test. Set the signal generator to a maximum level just before clipping for the signal path under test as measured on the oscilloscope.
   e) Remove the oscilloscope and connect a distortion analyzer to the output of the signal path under test.
   f) Perform this procedure for all signal paths in the audio system.
3) Documentation:
   a) Document the distortion readings as measured on the distortion analyzer for each signal path.

6. Acoustic Measurements
   a. The following procedures are the minimum requirements for this testing section. These procedures are guidelines only; refer to listed reference material for testing criteria. Manufacturer’s recommendations for operation and connectivity of specific test equipment shall be observed for all testing procedures. Perform all applicable procedures and document results.
   b. Perform testing procedures as applicable for the audio system under test.
   c. Hum and noise testing: verify the system is free of any hums, noises, buzzes, oscillations, or any other anomalies contributing to poor system operation. Correct any defects upon discovery. Contractor shall notify and coordinate with other trades to suppress any structural vibrations and noises cause by audio system.

   d. Polarity
      1) Polarity testing shall be conducted to determine the phase discrepancies within the sound system cabling.
         a) References:
      2) Procedure:
         a) Set signal path processing equipment except bandpass filters to bypass.
         b) Set signal path volume attenuators to minimum attenuation.
         c) Connect the polarity test equipment to the signal path input under test.
         d) Measure polarity on-axis to the loudspeaker under test.
         e) Correct any deficiencies upon discovery.
         f) Perform this procedure for all signal paths in audio system.

   e. Loudspeaker Frequency Response
      1) The frequency response of the loudspeakers shall be configured utilizing the audio system equalizers to provide an acoustic frequency response as defined within the Performance Standards section.
         a) References:

2) Procedure:
   a) Set signal path processing equipment except bandpass filters and system equalization to bypass.
   b) Set signal path volume attenuators to minimum attenuation.
   c) Connect a pink noise generator to the input of the signal path under test. Set the pink noise generator to a nominal level for signal path under test.
   d) Position the measurement microphone at an optimal testing position for loudspeaker under test.
   e) Utilize a real-time spectrum or fast fourier transform analyzer to measure the frequency response of the loudspeaker under test.
   f) Frequency Response Settings:
      1. Loudspeaker bandpass frequencies: set the bandpass filters to achieve frequency response as specified in the performance standards.
      2. Loudspeaker equalization: set equalization to achieve frequency response as specified in the performance standards.
   g) Perform this procedure for all loudspeaker networks in audio system.

3) Documentation:
   a) Document the frequency response for all loudspeaker networks.

f. Microphone Frequency Response

1) The frequency response of the microphones shall be configured utilizing audio system equalizers to provide an acoustic frequency response as defined within the Performance Standards section.

   a) References:

2) Procedure:
   a) Set signal path processing equipment except bandpass filters and system equalization to bypass.
   b) Set signal path volume attenuators to minimum attenuation.
   c) Connect a pink noise generator to the microphone input of the signal path under test. Set the pink noise generator to a nominal level for signal path under test.
   d) Position the measurement microphone at an optimal testing position for loudspeaker under test.
   e) Utilize a real-time spectrum or fast fourier transform analyzer to measure the frequency response of the loudspeaker under test.
   f) Frequency response settings:
1. Microphone bandpass frequencies: set the bandpass filters to achieve frequency response as specified in the performance standards.

2. Microphone equalization: set equalization to achieve frequency response as specified in the performance standards.

g) Perform this procedure for all microphone signal paths in audio system.

3) Documentation:
   a) Document the frequency response for all loudspeaker networks under test.

g. Feedback

1) The audio system shall be configured utilizing the audio system equalizers to provide the most gain before feedback.
   a) References:
   1. Don Davis and Carolyn Davis, “Equalizing the Sound System”, 
   Sound System Engineering, 2nd Ed. (Focal Press, Boston, 1997).

2) Procedure:
   a) Set signal path processing equipment except bandpass filters and system equalization to bypass.
   b) Set signal path volume attenuators to maximum attenuation.
   c) Connect a pink noise generator to a system input. Set the pink noise generator to a nominal level for signal path under test.
   d) Position the system microphone at a typical operator location.
   e) Utilizing a microphone signal splitter, connect the system microphone under test to both a frequency analyzer and the microphone input of the signal path under test.
   f) Utilize a real-time spectrum or fast fourier transform analyzer to measure the frequency response of the system microphone under test.
   g) Adjust signal path volume attenuators to increase the loudspeaker sound pressure levels until the audio system reaches feedback.
   h) Measure the feedback frequency.
   i) Mute the audio system.
   j) Frequency response settings:
   1. Set the system equalization to eliminate the feedback frequency.
   2. Perform this procedure for the microphone signal path under test until multiple frequencies feedback simultaneously.
   k) Perform this procedure for all microphone signal paths in the audio system.
h. Loudspeaker Coverage

1) The audio system shall be configured to provide uniform sound pressure levels within the audience areas.
   a) References:

2) Procedure:
   a) Connect a pink noise generator to a system input. Set the pink noise generator to a nominal level for the signal path under test.
   b) Utilize a sound pressure level meter to measure the uniformity of the loudspeaker coverage of the audience areas at listening heights.
   c) Correct any deficiencies in the loudspeaker coverage that deviate from that specified in the performance standards.

3) Documentation:
   a) Document deviations from that specified in the performance standards.

i. Reverberation

1) Measure the reverberation response of the room under test.
   a) References:

2) Procedure:
   a) Set signal path volume attenuators to minimum attenuation.
   b) Connect a pink noise generator to a system input. Set the pink noise generator to a nominal level for signal path under test.
   c) Position the measurement microphone within the center of the audience area.
   d) Energize system loudspeakers to the nominal sound pressure level as specified in the performance standards.
   e) Remove all signals from the loudspeakers.
   f) Utilize a real-time spectrum or fast fourier transform analyzer to measure the required time for all frequencies to fall below the ambient noise level.

3) Documentation:
   a) Document the reverberation time.
   b) Document the ambient noise level.

7. Video System Measurements

a. The following procedures are the minimum requirements for this testing section. These procedures are guidelines only; refer to listed reference material for testing criteria. Manufacturer’s recommendations for operation and connectivity of specific test equipment shall be observed for all testing procedures. Perform all applicable procedures and document results.
b. Test all video signal paths with field connection points, field cabling and video equipment in place.
   1) Multi-conductor cabling:
      a) Test all the conductors in the same manner as a single composite conductor.
      b) Document the worst performing conductor of the multi-conductor cable. Performance of the remaining conductors shall be assumed to exceed performance of documented conductor.

c. Noise and distortion testing: During the following procedures, verify system is free of any visual noises, oscillations, ground loop distortion or any other anomalies contributing to poor system operation. Correct any defects upon discovery.

d. Insertion Gain
   1) The insertion gain test shall be performed to verify the amplitude continuity of the video signal path.
      a) References:
   2) Procedure:
      a) Connect a video generator to the input of the signal path under test.
      b) Apply the “SMTPE color bar” test pattern.
      c) Connect a waveform monitor to the output of the signal path under test.
      d) Perform this procedure for all signal paths in video system.
   3) Documentation:
      a) Document the following as measured of the waveform monitor.
         1. White level.
         2. Black levels.
         3. Blanking levels.
         4. Sync levels.
         5. Sync pulse.

e. Frequency Response
   1) The frequency response test shall be performed to verify the uniform amplitude response as a function of frequency.
      a) References:
   2) Procedure:
      a) Connect a video generator to the input of the signal path under test.
      b) Apply the “multi-burst” test pattern.
      c) Connect a waveform monitor to the output of the signal path under test.
d) Perform this procedure for all signal paths in the video system.

3) Documentation:
   a) Document the amplitude level of each frequency burst packet.

f. Optical
   1) The light measurements shall be taken to verify the projector light output for uniformity, brightness and contrast.
   2) Procedure:
      a) Connect a video generator to the input of the signal path under test.
      b) Apply the “full white” test pattern.
      c) Utilizing a light meter, measure light output of projector under test.
      d) Perform this procedure for all projectors in the video system.
   3) Documentation:
      a) Document the ambient light levels at center of projection screen.
      b) Document the projector light levels at center of projection screen.
      c) Document the projector light levels at corners of projection screen.

8. Video System Measurements – Digital
   1) The following procedures are the minimum requirements for this testing section. These procedures are guidelines only; refer to listed reference material for testing criteria. Manufacturer’s recommendations for operation and connectivity of specific test equipment shall be observed for all testing procedures. Perform all applicable procedures and document results.
   2) Test all video signal paths with field connection points, field cabling and video equipment in place.
   3) Preform all test, provide all documentation, and follow all guidelines as detailed in the latest version of the following documents:
      a) Crestron DM Notes and Best Practices – DOC. 4575 12.10 or latter
      b) Crestron DM Cable Plant Certification – DOC. 4565B 9.11 or latter
      c) Crestron HD Digital Transport and Distribution System Specification – DOC. 4607 7.10 or latter

C. Acceptance Testing
   1. System acceptance testing shall not be conducted until all final “as-built” drawings, manuals and operational testing have been completed and the documentation has been submitted for Engineer’s review.
   2. Acceptance testing shall be conducted with Contractor, Engineer, and Owner in attendance.
   3. Contractor shall demonstrate that all components of the Audiovisual Systems are in proper working order and are in accordance with specifications.
   4. At time of acceptance testing, all items found to be outside of specification requirements; Owner requirements, code requirements or general installation practices shall be added as new items to
the final Punch List. All items found outside of specification requirements shall be put into working order prior to final acceptance of system.

5. The Contractor shall assemble an inventory of installed equipment. This inventory shall be complied at time of acceptance testing and compared to equipment listed in contractual documents.

6. Acceptance testing may be suspended by Engineer if Audiovisual Systems are not complete and operable, equipment failure occurs, or installation is not in accordance with specifications. Contractor shall be responsible for any cost incurred by Engineer for additional site visits required to complete acceptance testing.

D. MANUFACTURER SUPPORT CONTRACT(S)

1. The Contractor shall provide any manufacturer backed maintenance, warranty and/or technical support contract necessary for the Contractor to configure, operate, service, repair and/or replace any component of the Audiovisual System. The contract shall be valid for the duration of the warranty period. The Contractor shall purchase the contract in the Owner’s name and provide documentation and renewal information to the Owner at acceptance testing.

2. Video projectors shall have a 5 year warranty from the manufacturer

END OF SECTION 27 40 00
SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   2. System Smoke Detectors

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. NICET: National Institute for Certification in Engineering Technologies.

D. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.
   1. Include construction details, material descriptions, dimensions, profiles, and finishes.
   2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.
   1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   2. Include plans, elevations, sections, details, and attachments to other work.
   3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
   4. Detail assembly and support requirements.
   5. Include voltage drop calculations for notification-appliance circuits.
   6. Include battery-size calculations.
   7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
11. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified, fire-alarm technician; Level III minimum.
   c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
   a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
   d. Riser diagram.
   e. Device addresses.
f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

g. Manufacturer's required maintenance related to system warranty requirements.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

B. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.8 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.9 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.
PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:


B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.

D. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.
2.3 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Edwards

General Requirements for System Smoke Detectors:

2. Comply with UL 268; operating at 24-V dc, nominal.
3. Detectors shall be two-wire type.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
5. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
6. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
7. Integral Visual-Indicating Light: LED type, indicating detector has operated.

B. Photoelectric Smoke Detectors:
   1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
   1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
   1. Devices placed in service before all other trades have completed cleanup shall be replaced.
   2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

D. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

E. Smoke- or Heat-Detector Spacing:
   1. Comply with the “Smoke-Sensing Fire Detectors” section in the “Initiating Devices” chapter in NFPA 72, for smoke-detector spacing.
   2. Comply with the “Heat-Sensing Fire Detectors” section in the “Initiating Devices” chapter in NFPA 72, for heat-detector spacing.
   3. Smooth ceiling spacing shall not exceed 30 feet.
   4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
   5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.

3.3 PATHWAYS
A. Pathways shall be installed in EMT.
B. Exposed EMT shall be painted red enamel.

3.4 IDENTIFICATION
A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 GROUNDING
A. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL
A. Field tests shall be witnessed by authorities having jurisdiction.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Visual Inspection: Conduct visual inspection prior to testing.
a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.


3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.

5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

END OF SECTION 28 31 11