BEN LOMOND HIGH SCHOOL
AUDITORIUM REMODEL

PROJECT MANUAL

02/07/2023

KNIT

801-883-9328

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Ben Lomond High School Auditorium Remodel.

B. Owner's Name: Ogden School District.

C. This project is a renovation of the Ben Lomond High School auditorium and associated support spaces including upgrades to the theater production equipment, a new sound booth replacing the existing sound booth, new ticket booth at the auditoriums entrance, and converting an existing storage room into a new changing room as described and details in the construction documents.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 5200 - Agreement Form.

1.03 INDEPENDENT ENVIROMENTAL VERIFICATION

A. No independent verification is required. The Architect has incorporated Sustainable design principles into the project and the contract documents as specified. The Contractor is required to achieve these goals through selection and installation of products (materials and equipment) and as specified in the contract documents.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

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

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

D. Schedule the Work to accommodate Owner occupancy.

E. Substantial Completion: September 6, 2024

1.05 CONTRACTOR USE OF SITE

A. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Use of site and premises by the public.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

A. Document 00 2113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

B. Document 00 4323 - Alternates Form: List of Alternates as supplement to Bid Form.

1.03 ACCEPTANCE OF ALTERNATES

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

A.04 SCHEDULE OF ALTERNATES

A. Alternate No. 01 – Auditorium Painting: The contractor shall patch and prepare surfaces to receive paint; prime the surfaces to be painted; paint each surface with the color indicated by finish schedule with two coats of paint per color. The contractor shall patch and prepare surfaces to receive paint; prime the surfaces to be painted; paint each surface with the color indicated by finish schedule with two coats of paint per color.

B. Alternate No. 02 – Auditorium Seating: The contractor shall remove (and dispose) of (954 count V.I.F.) existing seating and associated mounting hardware, patch and repair existing floor and prepare floor surface for new epoxy paint. The contractor shall patch and repair existing floor and prepare and paint floor surface with epoxy paint, install (1000) fixed auditorium seats; basis of design for seating: Irwin Seating Company Citation Model 90.12.10.4 with owner selected finishes and accessories.

C. Alternate No. 03 – Stage Power & Data: The contractor shall remove existing XLR and Crewcom outlets and boxes from center, front of stage complete. The contractor shall repair wood wainscott where boxes were removed in demolition scope by providing new wood wainscott panel complete to match existing. where wood wainscott was salvaged from auditorium sidewall in add alt #4., contractor to use salvaged wainscott.

D. Alternate No. 04 – Auditorium Sidewall: the contractor shall remove and salvage existing wood wainscotting from the sidewalls to be reused as finish as part of sound booth base bid item and add alt #3.

   a. Option 1: The contractor shall extend construction of existing upper barrel vaulting to finish floor below, new barrel vaults to be painted as instructed in add alternative #01.

   b. Option 2: The contractor shall install barrel diffusers on flat surfaces of both sidewalls; basis of design: qts acc-u-sound battel diffusers or equivalent.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electronic document submittals.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

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

F. Number of copies of submittals.

G. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 3117 - Request for Interpretation.

B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTALS

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via email or uploaded to the Architect via Newforma® Project Center.
   1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, and any other document any participant wishes to make part of the project record.
   2. It is Contractor's responsibility to submit documents in PDF format.
   3. Subcontractors, suppliers, and Architect's consultants will be permitted to Newforma® Project Center at no extra charge.
   4. Users of Newforma® Project Center need an email address, Internet access, and PDF review software (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com).
   5. Paper document transmittals will not be reviewed.
   6. All other specified submittal and document transmission procedures apply, except that electronic document requirements to not apply to samples or color selection charts.

B. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.

4. Submission of schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract and Architect.
6. Communication and Correspondence requirements.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.
9. Claims for delays.

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

3.03 SITE MOBILIZATION MEETING

A. Architect will schedule a meeting at the Project site prior to Contractor occupancy.

B. Site Mobilization Meeting may be combined with the Preconstruction Meeting.

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

D. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy prior to completion.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

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

3.04 PROGRESS MEETINGS

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

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

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

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.

10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

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

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216

3.06 SUBMITTALS FOR REVIEW

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

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

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

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.07 SUBMITTALS FOR INFORMATION

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

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

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. IAQ Management Plan.
   6. Final Summary Of Solid Waste Disposal And Diversion.
   7. Other types as indicated.

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

3.09 NUMBER OF COPIES OF SUBMITTALS

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

B. Samples: Submit the number specified in individual specifications sections; samples will be returned to Contractor.
   1. Contractor to maintain record copies of returned samples on-site.

3.10 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

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

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

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

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

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

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

H. Provide space for Contractor and Architect review stamps.

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

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

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

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

C. Recovery Schedules.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule .

B. Within 10 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

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

D. Submit updated schedule with each Application for Payment.

1.03 RECOVERY SCHEDULES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a preliminary network diagram.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes. Include schedule for owner-furnished products and products identified under Allowances, if any.

E. Indicate delivery dates for owner-furnished products identified under Allowances, if any.

F. Coordinate content with schedule of values specified in Section 01 2000.

G. Provide legend for symbols and abbreviations used.

3.03 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.

6. Actual start date.
7. Actual finish date.
8. Latest start date.
9. Latest finish date.
10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
11. Monetary value of activity, keyed to Schedule of Values.
12. Percentage of activity completed.
13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest.
2. By amount of float, then in order of early start.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance submittals.

B. Control of installation.

C. Tolerances.

D. Testing and inspection services.

1.02 RELATED REQUIREMENTS

A. Section 01 4216 - Definitions.

1.03 SUBMITTALS

A. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

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

E. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

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

2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.04 REFERENCES AND STANDARDS

1.05 TESTING AND INSPECTION AGENCIES

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 TOLERANCES

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

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

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

3.03 TESTING AND INSPECTION

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

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

C. Contractor Responsibilities:

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

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

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

3.04 DEFECT ASSESSMENT

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

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

END OF SECTION

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Vehicular access and parking.

D. Waste removal facilities and services.

E. Project identification sign.

1.02 RELATED REQUIREMENTS

A. Section 01 5500 - Vehicular Access and Parking.

B. Section 01 3553 - Security Procedures.

1.03 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

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

1.04 TEMPORARY SANITARY FACILITIES

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

B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

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

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

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

1.06 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. Maximum flame spread rating of 75 in accordance with ASTM E84.

C. Paint surfaces exposed to view from Owner-occupied areas.

1.07 SECURITY - SEE SECTION 01 3553

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

1.08 VEHICULAR ACCESS AND PARKING

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

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

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

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

1.09 WASTE REMOVAL

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

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

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

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

1.10 PROJECT IDENTIFICATION

A. Contractor may provide and install one Contractor's identification sign, 48 s.f. maximum, at location approved by Architect/Owner.

B. Contractor shall install Architect's provided identification sign, 48 s.f., at location approved by Architect/Owner.

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

1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

B. Remove underground installations to a minimum depth of 2 feet (600 mm).

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5721
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. HVAC equipment and ductwork may NOT be used for ventilation during construction unless approved by Architect:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.

4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
5. Clean return plenums of air handling units.
6. Remove intake filters last, after cleaning is complete.

G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

H. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transportation, handling, storage and protection.

B. Product option requirements.

C. Substitution limitations and procedures.

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

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS

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

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

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

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

B. Do not use products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of vegetable materials that are rapidly renewable.

2.02 PRODUCT OPTIONS

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

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

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

2.03 MAINTENANCE MATERIALS

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

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

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

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

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

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

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

F. Substitution Submittal Procedure:
   1. Transmit request for substitution with three copies of the CSI Form Substitution Request (During the Bidding Phase).
   2. Submit one electronic copy of request for substitution for consideration. Limit each request to one proposed substitution.
   3. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   4. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

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

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

C. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

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

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

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Closeout procedures, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

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

D. Submit Final Cleaning program indicating administrative, procedural, and product requirements for final cleaning.

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

1.04 QUALIFICATIONS

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

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

1.05 PROJECT CONDITIONS

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

B. Protect site from puddling or running water.

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

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

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

F. Smoking Control: Provide methods and means to prevent smoking near or within facilities once the superstructure is in place and work on the building are upon completion of the superstructure and commencement of the exterior enclosure.

1.06 COORDINATION

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

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

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

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

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

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

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

1.07 CLEANING REQUIREMENTS

A. Special cleaning requirements for specific construction elements are included in appropriate sections.

1.08 FINAL CLEANING REQUIREMENTS

A. Purpose: To employ processes that utilize equipment and products to ensure a clean environment for the building occupants while reducing contaminants to the extent technologically and economically feasible.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 PREINSTALLATION MEETINGS

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

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

C. Notify Architect four days in advance of meeting date.

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

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

3.04 LAYING OUT THE WORK

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

B. Promptly notify Architect of any discrepancies discovered.

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

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

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

F. Utilize recognized engineering survey practices.

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

H. Periodically verify layouts by same means.

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

3.05 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

3.06 CUTTING AND PATCHING

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

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

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

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

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

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

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

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

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

3.07 PROGRESS CLEANING

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

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

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

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

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.09 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Cleaning Equipment:
   1. Powered custodial equipment including floor buffers, burnishers and automatic scrubbers will be equipped with vacuum, guards and/or other devices for capturing fine particles.
   2. Use micro fiber dusting cloths and flat mops to capture dirt and remove it.

C. Use cleaning materials that are nonhazardous.
   1. Comply with Geen Seal GS 37 for general purpose cleaning and bathroom cleaning. Use natural cleaning materials where feasible.

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

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

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

G. Clean filters of operating equipment.

H. Clean debris from roofs, gutters, downspouts, and drainage systems.

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

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

3.10 CLOSEOUT PROCEDURES

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

B. Notify Architect when work is considered ready for Substantial Completion.

C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

E. Notify Architect when work is considered finally complete.

F. Complete items of work determined by Architect's final inspection.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

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

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

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

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

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

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

D. Record information concurrent with construction progress.

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

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

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

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

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

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

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

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

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

F. Include sequence of operation by controls manufacturer.

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

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

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

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

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

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

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

G. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

H. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

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

END OF SECTION

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

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

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

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

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

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

2.02 EXISTING UTILITIES

A. Protect existing utilities to remain from damage.

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

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

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

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

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

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, and Electrical): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

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

2.04 DEBRIS AND WASTE REMOVAL

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

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

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

END OF SECTION

SECTION 06 4100

PLASTIC-LAMINATE FACED ARCHITECTURAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic-laminate faced architectural cabinet units.

B. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

C. Cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. On casework and countertop elevations show the location of backing required for attachment within walls.

2. Provide the information required by AWI/AWMAC/WI (AWS).

3. Include certification program label.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Certified Seismic Installation Program:

1. Before walls are closed up provide a written Woodwork Institute Certified Seismic Installation Program report confirming that backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located.

2. On completion of installation provide a Woodwork Institute Certified Seismic Installation Program Certificate, identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.

3. All fees charged by the Woodwork Institute for their Certified Seismic Installation Program are the responsibility of the millwork installer and shall be included in their bid.

C. Single Source Responsibility: A single manufacturer shall provide and install the work of described in this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 PLASTIC-LAMINATE FACED ARCHITECTURAL **CABINETS**

A. A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.

B. Grade: Premium.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay with 3mm pvc edge banding, to match exposed face, all four edges of door and drawer fronts.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.

b. Pionite: a Panolam Industries International, Inc. brand

c. Wilsonart International Holdings, Inc.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.

2. Vertical Surfaces: Grade HGS.

3. Edges: 3 mm PVC

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

    a. Edges of cabinet shelves" 3 mm PVC edge banding matching laminate in color, pattern, and finish.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.

3. Drawer Bottoms: Thermoset decorative panels.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

    a. Solid colors, matte finish.

    b. Patterns, matte finish.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated

1. Wood Moisture Content: 5 to 10 percent.

2. Particleboard: ANSI A208.1, Grade M-2.

3. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

D. Core: MDF meeting the requirements of Architectural Woodwork Standards.

2.03 LAMINATE MATERIALS

A. Manufacturers:

1. Wilsonart, LLC: www.wilsonart.com.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

1. Type: Through color.

2. Color: Tan Echo 7941K-18.

2.04 ACCESSORIES

A. Adhesive: Water-based contact adhesive, Greenguard Indoor Air Quality Certified.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. 3mm PVC edge banding

1. Color: 2114 Almond

2.05 HARDWARE

A. A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening[, self-closing.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal.

F. Drawer Slides: BHMA A156.9.

1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.

G. Door Locks: BHMA A156.11, E07121.

H. Drawer Locks: BHMA A156.11, E07041.

I. Door and Drawer Silencers: BHMA A156.16, L03011.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

2.06 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to

produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 EXECUTION

3.01 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.02 INSTALLATION

B. Grade: Install cabinets to comply with same grade as item to be installed.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

G. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

H. Revise requirements in subparagraph below as necessary for seismic restraint of cabinets. Delete if hanging cleats are used and are detailed on Drawings.

I. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips, or, No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation.

1.02 RELATED REQUIREMENTS

A. Section 09 2216 – Non-Load Bearing Wall Framing: Supporting construction for batt insulation.

1.03 REFERENCE STANDARDS

A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in interior metal framed walls: Batt insulation.

2.02 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Thermal Resistance: R-value (RSI-value) as required for scheduled wall.
   6. Facing: Unfaced.

7. Manufacturers:
    a. CertainTeed Corporation; www.certainteed.com.
    b. Johns Manville; www.jm.com.
    c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

2.03 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
    1. Application: Sealing of interior circular penetrations, such as pipes or cables.
    2. Width: Are required for application.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

F. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches (150 mm) on center. Lap and seal sheet retarder joints over member face.

G. Tape seal tears or cuts in vapor retarder.

H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

B. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.02 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gunnable and Pourable Sealants:
   1. Adhesives Technology Corporation: www.atcepoxy.com.
   2. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   3. Bostik Inc: www.bostik-us.com.
   4. Dow Corning Corporation: www.dowcorning.com.
   5. Hilti, Inc: www.us.hilti.com.
   6. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
   7. Pecora Corporation: www.pecora.com.
   8. The QUIKRETE Companies: www.quikrete.com.
   9. Red Devil: www.reddevil.com.
   10. Tremco Global Sealants: www.tremcosealants.com.
   11. Sherwin-Williams Company: www.sherwin-williams.com.
   12. W.R. Meadows, Inc: www.wrmeadows.com.
   13. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel frames for wood doors.

1.02 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.

C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).

D. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

E. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
   2. De La Fontaine Inc: www.delafontaine.com.
   3. Republic Doors: www.republicdoor.com.
   4. Steelcraft, an Allegion brand: www.allegion.com/us.
   5. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   1. Accessibility: Comply with ANSI/ICC A117.1.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
   8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

2.04 STEEL FRAMES

A. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage
   2. Finish: Same as for door.

2.05 ACCESSORY MATERIALS

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

B. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. Coordinate frame anchor placement with wall construction.

C. Coordinate installation of hardware.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; non-rated.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Specimen warranty.

D. Samples: Submit two samples of door construction, 6" by 6" inch in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 6" by 6" inch in size illustrating wood grain, stain color, and sheen.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Warranty, executed in Owner's name.

1.04 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Eggers Industries: www.eggersindustries.com.
   2. Haley Brothers: www.haleybros.com.
   3. Marshfield Door Systems, Inc: www.marshfielddoors.com
   4. Oshkosh Door Company
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.

1. Quality Level: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
1. Provide solid core doors at all locations .
2. Wood veneer facing with factory transparent finish where indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: White Oak, veneer grade as specified by quality standard, plain sliced, book veneer match, running assembly match; unless otherwise indicated.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 08 5113 - Aluminum Windows: Operable sash within glazing system.

C. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

F. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples in size illustrating finished aluminum surface, glass , glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Manufacturer Qualifications Statement.

H. Installer Qualifications Statement.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer Trifab 601T Framing System.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Narrow Stile, Insulating Glazing, Thermally-Broken:
   1. Basis of Design: Kawneer.

2.03 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class II natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   2. Finish Color: Match existing.
   3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections , thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 8000.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: Match existing wide.
   3. Vertical Stiles: Match existing wide.
   4. Bottom Rail: Match existing wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront, match existing.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.06 FINISHES

A. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils (0.01 mm) thick.

B. Color: Match existing.

2.07 HARDWARE

A. For each door, include: hinges, push-pulls and threshold.

B. Hinges: Top Off Set Pivot, provide on all doors.

C. Push / Pulls: Kawneer standard, CP Double Acting, provide on all doors, each side.

D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances , aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.02 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.03 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.04 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.05 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, hollow steel, and aluminum doors.

B. Hardware for fire-rated doors.

C. Thresholds.

D. Weather-stripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

A. Section 28 1300 - Access Control : Electronic access control devices.

1.03 REFERENCE STANDARDS

A. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; Builders Hardware Manufacturers Association; 2011 (ANSI/BHMA A156.2).

B. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2008 (ANSI/BHMA A156.3).

C. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc.; 2008 (ANSI/BHMA A156.4).

D. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2010 (ANSI/BHMA A156.8).

E. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012 (ANSI/BHMA A156.22).

F. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2007 (ANSI/BHMA A156.31).

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

H. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

D. Keying Schedule: Submit for approval of Owner.

E. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.06 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 DOOR HARDWARE - GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:

1. Applicable provisions of federal, state, and local codes.
2. Fire-Rated Doors: NFPA 80.
3. All Hardware on Fire-Rated Doors : Listed and classified by UL as suitable for the purpose specified and indicated.

2.02 HINGES

A. Hinges: Provide hinges on every swinging door.
   1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   2. Provide ball-bearing hinges at all doors having closers.
   3. Provide hinges in the quantities indicated.
   4. Provide non-removable pins on exterior out swinging doors.
   5. Where electrified hardware is mounted in door leaf, provide power transfer hinges.

B. Manufacturers:
   1. Ives/Glynn-Johnson
   2. No Substitutions allowed

2.03 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. Hardware Sets indicate locking functions required for each door.
   2. If no hardware set is indicated for a swinging door provide an office lockset.
   3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Grand master keyed.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

E. Manufacturers:
   1. Schlage (Owner's Standard)
   2. Sargent (Owner's Standard)

2.04 CYLINDRICAL LOCKSETS

A. Locking Functions: As defined in BHMA A156.2 Grade 1, and as follows:
   1. Classroom Function: ANSI# F84, Deadlocking latch by lever inside, Outside lever locked or unlocked by key.
   2. Storage Room Function: ANSI# F86, Deadlocking latch by lever inside, key outside. Outside lever always locked.

B. Manufacturers - Cylindrical Locksets:
   1. Marks 195 Locksets
   2. Schlage ND, approved substitution
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.05 CLOSERS

A. Closers: Complying with ANSI BHMA A156.4. Grade 1
   1. Provide surface-mounted, door-mounted closers unless otherwise indicated.

B. Manufacturers - Closers:
   1. LCN (Owner's Standard), an Allegion brand: www.allegion.com/us.
   2. No substitutions allowed

2.06 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
   1. Provide wall stops, unless otherwise indicated.
   2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
   3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

B. Manufacturers - Wall and Floor Stops/Holders:
   1. Ives/Glynn-Johnson.
   2. No substitutions allowed.

2.07 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:
   1. Kickplate: Provide on push side of every door with closer, except storefront and all-glass doors.

B. Manufacturers - Protection Plates and Architectural Trim:
   1. Ives/Glynn-Johnson.
   2. No substitutions allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 7000.

B. Adjust hardware for smooth operation.

HARDWARE SETS

4.01 GENERAL

A. These Hardware Sets indicate requirements for single doors of that type, with conditional requirements for pairs and other situations.

HW SET 01 – CLASSROOM FUNCTION – ANSI# F84

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	MATCH EXISTING	IVES
1	EA	CLASSROOM LOCK	195	MATCH EXISTING	MARKS
1	EA	WALL STOP	WS406/407CCV	MATCH EXISTING	IVES
1	EA	KICK PLATE	10” X 2” LDW	MATCH EXISTING	IVES
1	SET	SILENCERS	SR64	MATCH EXISTING	IVES

HW SET 02 – STORAGE ROOM FUNCTION – ANSI# F86

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	MATCH EXISTING	IVES
1	EA	STOREROOM LOCK	195	MATCH EXISTING	MARKS
1	EA	WALL STOP	WS406/407CCV	MATCH EXISTING	IVES
1	EA	KICK PLATE	10” X 2” LDW	MATCH EXISTING	IVES
1	SET	SILENCERS	SR64	MATCH EXISTING	IVES

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing units.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

D. ASTM C1036 - Standard Specification for Flat Glass; 2011.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

I. GANA (GM) - GANA Glazing Manual; 2009.

J. GANA (SM) - GANA Sealant Manual; 2008.

K. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).

M. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12 by 12 inch (___ by ___ mm) in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), IGMA TM-3000, for glazing installation methods. Maintain one copy on site.

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

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

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
   4. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.03 GLAZING UNITS – GL-1

A. Monolithic Safety Glazing: Non-fire-rated.
   1. Applications:
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
   2. Glass Type: Fully tempered safety glass as specified.
   3. Tint: Clear.
   4. Thickness: 1/4 inch (6.4 mm), nominal.

2.4 SEALED INSULATING GLASS UNITS – GL-2:

A. General: Provide preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E 774 for performance classification indicated as well as with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner design and dessicant.

   1. For properties of individual glass panes making up units, refer to product requirements

specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.

2. Provide heat-treated panes of kind and at locations indicated or, if not indicated, provide heat-strengthened panes where recommended by manufacturer for application indicated and tempered where indicated or where safety glass is designated or required.
3. Performance Classification per ASTM E 774: Class A.

    a. Overall Unit Thickness: 1 inch (25 mm).
    b. Thickness of Each Pane: 1/4".
    c. Air Space Thickness: 1/2".
    d. Sealing System: Dual seal; primary and secondary sealant: manufacturer's standard materials except secondary sealant to be silicone.
    e. Spacer Material: Aluminum.

4. Dessicant: Manufacturer's standard; either molecular sieve or silica gel or blend of both.
5. Corner Construction: Manufacturer's standard corner construction.

B. Insulating Glass Units: Manufacturer's standard units complying with the following requirements:

1. Exterior Pane: Clear (Tinted to match existing)
2. Interior Pane: Clear. (Tinted to match existing)

2.05 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

C. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

D. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.03 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.04 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 2216
NON-LOAD-BEARING WALL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Optional Self-Locking metal framing for interior non-load-bearing walls.

1.02 RELATED SECTIONS:

A. Section 09 2116 -Gypsum Board Assemblies for gypsum board installed on non-loadbearing wall framing.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

1.04 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for two years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Regulatory Approvals:
   1. International Building Code, Section 2209.1.
   2. ICC-ES approval, Report Number ESR-1494.
   3. ANSI/UL263 for nonbearing wall assemblies U419, U411, U412, U403.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Framing for Interior Non-Load-Bearing Walls: Self-locking metal studs, telescoping stud extensions and tracks with the following characteristics:

B. System: Trakloc Steel Framing by Trakloc International, Temecula, CA.

C. Steel Studs and Tracks: Comply with ASTM C 645; fabricate from ASTM A 653, SS Grade 33 steel with ASTM A 645 G40 galvanizing.

D. Stud and Track Sizes: As indicated on the Partition Schedule on the Drawings, including the following as applicable:
   1. Studs 2-1/2 inches deep; 0.179 inch, 0.0237 inch and 0.0296 inch thicknesses.
   2. Studs 3-1/2 inches deep; 0.179 inch, 0.0237 inch and 0.0296 inch thicknesses.
   3. Studs 3-5/8 inches deep; 0.179 inch, 0.0237 inch and 0.0296 inch thicknesses.
   4. Studs 5-1/2 inches deep; 0.0296 inch thickness.
   5. Studs 6 inches deep; 0.0296 inch thickness.

E. Cutouts in Studs: 4 inch by 1-1/2 inch service holes on 24 inch centers, starting 12 inches from stud bottom.

F. Telescoping Portions: Lengths as recommended by manufacturer based on project conditions.

G. Fasteners: As recommended by manufacturer based on project conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Metal Framing Installation: Comply with manufacturers instructions and recommendations including the following:

B. Spacing and spans shall not exceed manufacturer’s published recommendations.

C. Install studs and extensions in tracks using self-locking mechanism.

D. At blocking and special configurations where fasteners are required, attach studs using pan head screws into the recessed portion of the track.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for wood framing and furring that supports gypsum board.
2. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
3. Division 7 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
4. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
5. Division 9 painting Sections for primers applied to gypsum board surfaces.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. American Gypsum Co.
    b. BPB America Inc.
    c. G-P Gypsum.
    d. Lafarge North America Inc.
    e. National Gypsum Company.
    f. PABCO Gypsum.
    g. Temple.
    h. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. James Hardie Building Products, Inc..; HardieBacker 500 Cement Board.
    b. USG Corporation; DUROCK Cement Board.
2. Thickness: 5/8 inch.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    e. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. manufacturer.

D. Joint Compound for Tile Backing Panels:
1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

E. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: typical, unless noted otherwise.
2. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges where indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on drawings.
4. Level 4: All panel surfaces, unless otherwise indicated by the drawings or this specification.
    a. Primer and its application to surfaces are specified in other Division 9 Sections.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

C. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014)e1.

D. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
   1. Recycled Content:
      a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
      b. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.

C. Verification Samples: Submit two samples, illustrating color and pattern for each resilient flooring product specified.

D. Concrete Testing Standard: Submit a copy of ASTM F710.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 10 square feet of each type and color.
   3. Extra Wall Base: 30 linear feet of each type and color.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Protect roll materials from damage by storing on end.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

2.02 TILE FLOORING

A. F1 - Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
   1. Manufacturers:
      a. Armstrong Flooring: www.armstrongflooring.com/en-us
   2. Minimum Requirements: Comply with ASTM F1066, of Class 2.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   4. Size: 12 by 12 inch.
   5. VOC Content Limits: As specified in Section 01 6116.
   6. Recycled Content: Minimum [5] percent post-consumer recycled content, or minimum [35] percent pre-consumer recycled content.
   7. Thickness: 0.125 inch.
   8. Average Weight: 1.4 lbs. per tile (0.6 kg per tile).
   9. Static Load Resistance: 125 psi (860 kPa) minimum, when tested as specified in ASTM F970.
   10. Model: Standard Excelon Imperial Texture
   11. Color/Pattern: Polar White, Pattern to match existing.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

3.05 INDOOR AIR QUALITY

A. Temporary ventilation: Provide temporary ventilation as specified in Section 01 5721 - Indoor Air Quality Controls, and as follows.

1. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by Architect.

3.06 WASTE MANAGMENT

A. Waste Management: As specified in Section 01 7419 - Construction Waste Management and Disposal as follows:

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 8400
ACOUSTIC WALL PANELS

PART 1 GENERAL

1.01 RELATED DOCMUENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

A. Section Includes:

1. Cementitious wood fiber plank acoustical wall system

B. Related Sections:

1. Section 09 20 00 – Plaster and Gypsum Board
2. Section 01 81 13 – Sustainable Design Requirements
3. Section 01 81 19 – Indoor Air Quality Requirements

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
2. XASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
3. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code

C. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

D. NFPA 70 National Electrical Code

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data for each type of Fabric walls required.

B. Samples: Minimum 6 inch x 6 inch samples of specified Tectum® Fabric acoustical panel.

C. Shop Drawings: Layout and details of Tectum® Fabric walls show locations of items that are to be coordinated with, or supported by the walls.

D. Certifications: Manufacturer’s certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, products must be tested to the A, D-20, or C-40 method; each carton of material must carry an approved independent laboratory classification.

E. If the material supplied by the acoustical subcontractor does not conform to manufacturer’s current published values as specified in 2.2 of this specification, the material must be removed, disposed of, and replaced with complying product at the expense of the Contractor performing the work.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical wall components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: Tested per ASTM E 84 and complying with ASTM E 1264 Classification.

C. Tectum® Fabric, as with other architectural features located at the wall, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate acoustical wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.06 DELIVERY, STORAGE & HANDLING

A. Deliver acoustical wall units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Provide labels indicating brand name, style, size and thickness.

C. Before installing acoustical wall units, permit them to reach room temperature and a stabilized moisture content.

D. Handle acoustical wall units carefully to avoid chipping edges or damaged units in any way.

1.07 ENVIRONMENTAL REQUIREMENTS:

A. Do not install wall panels until building is closed in and HVAC system is operational.

B. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

C. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:

1. Relative Humidity: 65 - 75%.
2. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).

1.08 WARRANTY:

A. Fabric Panels: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Fabric Wall Panels: Sagging and warping

B. Fabric Wall Panels one source manufacturer is Thirty (30) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents

1.09 MAINTENANCE:

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Fabric Custom Wall Panels: Furnish quality of full-size units equal to 5.0 percent of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Fabric Custom Wall Panels:

1. Tectum® by Armstrong World Industries, Inc.

2.02 FABRIC CUSTOM WALL PANELS

A. Acoustical Panels Type AP-1:

1. Surface Texture: Coarse
2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement

3. Fabric: (Custom: refer to manufacturer website for fabric selection)
4. Size: Custom Sizes (width 24”, length 48”)
5. Thickness: (2”)
6. Edge Profile: Beveled
7. Noise Reduction Coefficient (NRC): ASTM C 423 ; (Mounting; C-40(0.90)

B. Acoustical Panels Type AP-2:

1. Surface Texture: Coarse
2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
3. Fabric: (Custom: refer to manufacturer website for fabric selection)
4. Size: Custom Sizes (width 24”, length 60”)
5. Thickness: (2”)
6. Edge Profile: Beveled
7. Noise Reduction Coefficient (NRC): ASTM C 423 ; (Mounting; C-40(0.90)

C. Acoustical Panels Type AP-3:

1. Surface Texture: Coarse
2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
3. Fabric: (Custom: refer to manufacturer website for fabric selection)
4. Size: Custom Sizes (width 24”, length 72”)
5. Thickness: (2”)
6. Edge Profile: Beveled
7. Noise Reduction Coefficient (NRC): ASTM C 423 ; (Mounting; C-40(0.90)

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations.

3.02 PREPARATION

A. Measure each wall area and establish layout of acoustical wall units, and comply with reflected wall plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other wall anchors whose installation is specified in other sections.

3.03 INSTALLATION

A. Install Fabric Custom Wall Panels in accordance manufacturer’s installation instructions.

B. Fabric Custom Wall Panels must be mechanically attached to approve substrate per installation instructions.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken Tectum® Fabric Wall Panels.

B. Clean exposed surfaces of acoustical walls, including trim, edge moldings, and suspension members. Comply with manufacturer’s instructions for cleaning and touch up of minor finish damage. Remove any Tectum® Fabric Wall Panels that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Prime surfaces to receive wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically so indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

C. Samples: Submit two paper chip samples, illustrating range of colors available for each surface finishing product scheduled.

D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. Paints:
1. Base Manufacturer: Frazee Paint, a Comex Group Company: www.frazee.com..
2. Comex Group (Color Wheel, Frazee, General Paint, Kwal, or Parker): www.thecomexgroup.com.
3. Glidden Professional: www.gliddenprofessional.com.
4. Benjamin Moore & Co: www.benjaminmoore.com.
5. PPG Architectural Finishes, Inc: www.ppgaf.com.
6. Sherwin-Williams Company: www.sherwin-williams.com.
7. Dunn Edwards: www.dunnedwards.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Recycled Content: Minimum [20] percent post-consumer recycled content for light colors; minimum [50] percent post-consumer recycled content for dark colors.

E. Finish coats shall not be thinned.

F. Number of coats scheduled is minimum to achieve required finish. Additional coats shall be applied at no additional cost if necessary to completely hide base materials, produce a uniform color and provide satisfactory finish results.

G. Colors: As indicated on drawings
1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint CE-OP-3LA - Masonry/Concrete, Opaque, Acrylic, 3 Coat:
1. One coat of epoxy acrylic block filer; 266 Epotilt for concrete or non-porous masonry, 262 Acrylic Block Filler for CMU or porous masonry.
2. Eggshell: Two coats of 100% acrylic; 122 Endurable EG.
3. Dry film thickness shall be no less than 4.5 mils for concrete or brick and no less than 8 mils for CMU.

B. Paint ME-OP-3LA - Ferrous Metals, Unprimed, Acrylic, 3 Coat:
1. One coat of acrylic metal primer; 561 Acrylic Metal Primer.
2. Semi-gloss: Two coats of 100% acrylic; 131 Endurable SG.
3. Dry film thickness shall be no less than 4.5 mils.

C. Paint ME-OP-2LA - Ferrous Metals, Primed, Acrylic, 2 Coat:
1. Touch-up with metal primer; 561 Acrylic Metal Primer.
2. Semi-gloss: Two coats of 100% acrylic; 131 Endurable SG.
3. Dry film thickness shall be no less than 4.5 mils.

D. Paint MgE-OP-3LA - Aluminum and Galvanized Metals, Acrylic, 3 Coat.
1. One coat galvanize primer.
2. Semi-gloss: Two coats of 100% acrylic; 131 Endurable SG .
3. Dry film thickness shall be no less than 4.5 mils.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint MI-OP-3LA - Ferrous Metals, Unprimed, Acrylic, 3 Coat:
1. One coat of acrylic or acrylic resin primer; 066 Envirokote Primer or 561 Acrylic Metal Primer (semi-gloss or gloss only).
2. Semi-Gloss: Two coats of 100% acrylic; 032 Envirokote SG.
3. Dry film thickness shall be no less than 4.5 mils.

C. Paint MI-OP-2LA - Ferrous Metals, Primed, Acrylic, 2 Coat:
1. Touch up with acrylic or acrylic resin primer; 066 Envirokote Primer or 561 Acrylic Metal Primer (semi-gloss or gloss only).
2. Semi-Gloss: Two coats of 100% acrylic; 032 Envirokote SG.
3. Dry film thickness shall be no less than 4.5 mils.

D. Paint Mgl-OP-3LA - Aluminum and Galvanized Metals, Acrylic, 3 Coat:
1. One coat of acrylic or acrylic resin primer; 066 Envirokote Primer or 561 Acrylic Metal Primer (semi-gloss or gloss only).
2. Semi-Gloss: Two coats of 100% acrylic; 032 Envirokote SG.
3. Dry film thickness shall be no less than 4.5 mils.

E. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
1. One coat of vinyl acrylic or acrylic resin primer sealer; 066 Envirokote Primer or 061 Aqua Seal (semi-gloss or gloss only).

2. Gloss: Two coats of latex-acrylic enamel; 144 Endurable GL.
3. Semi-gloss: Two coats of latex-acrylic enamel; 131 Endurable SG.
4. Eggshell: Two coats of latex-acrylic enamel; 122 Endurable EG .
5. Flat: Two coats of latex enamel-acrylic; 018 Envirokote FL.

2.05 FLOOR COATINGS

A. Interior / Exterior Epoxy Floor Paint (Solvent Based) SC-1
   1. See SECTION 09 9600 HIGH PERFORMANCE COATINGS

B. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

J. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

K. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

L. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

M. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 099600
HIGH-PERFORMANCE COATINGS

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 surface preparation and the application of high-performance coating system on the following substrates:

1. Interior Substrates:

a. Concrete, horizontal surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Label each coat of each Sample.
3. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.

a. Floor Surface: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture’s label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

E. Hazardous Materials: Hazardous materials including lead paint may be present in buildings and structures to be painted. A report on the presence of known hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified.
2. Perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product:

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC content limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Floor Coatings: 100 g/L.
6. Shellacs, Clear: 730 g/L.
7. Shellacs, Pigmented: 550 g/L.

C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Service's "Standard Practice for the Testing of Volatile Organic Chemical Emissions from Various Sources Using Small Scale Environmental Chambers."

D. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and

primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report in writing conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.

2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Horizontal Surfaces.

1. Epoxy System:

a. Prime Coat: Epoxy, matching topcoat.

b. Topcoat: Epoxy, Gloss:
   1) S-W Armorseal 8100 Water Based Epoxy Floor Coating, B70 Series, at 2.0 to 4.0 mils dry, per coat.
   2) Finish: Satin
   3) Color: Clear

END OF SECTION

SECTION 10 2800

WASHROOM ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Washroom accessories as scheduled in this Section and as indicated on the Drawings.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry, coordination with blocking.

B. Section 092000 - Plaster and Gypsum Board, coordination with blocking.

C. Section 093000 - Tiling, coordination with layout and installation.

D. Section 102113 - Toilet Compartments, coordination with accessories.

E. Section 102814 - Baby Changing Stations, for baby changing stations.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for each product specified, including the following:

1. Installation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Cleaning and maintenance instructions.
4. Replacement parts information.

B. Schedule: Submit an accessory schedule, indicating the type and quantity to be installed in each washroom. Use room numbers as indicated on the Drawings.

1.04 QUALITY ASSURANCE

A. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.06 WARRANTY

A. Manufacturer’s Warranty for Washroom Accessories: Manufacturer’s standard 1 year warranty for materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design Products: The project, specifications are based on the products of Bobrick Washroom Equipment, Inc.

B. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the contractor's submission of adequate documentation of the substitution in accordance with procedures in section 01 6000 Product Requirements

2.02 ACCESSORY SCHEDULE

A. B-290 Series Angle-Frame Mirror.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in strict compliance with manufacturer’s written instructions and recommendations, including the following:

1. Verify blocking has been installed properly.
2. Verify location does not interfere with door swings or use of fixtures.
3. Comply with manufacturer’s recommendations for backing and proper support.
4. Use fasteners and anchors suitable for substrate and project conditions
5. Install units rigid, straight, plumb, and level, in accordance with manufacturer’s installation instructions and approved shop drawings.
6. Conceal evidence of drilling, cutting, and fitting to room finish.
7. Test for proper operation.

3.02 CLEANING AND PROTECTION

A. Clean exposed surfaces of compartments, hardware, and fittings using methods acceptable to the manufacturer.

B. Touch-up, repair or replace damaged products until Substantial Completion.

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid Surface Countertops

B. Plastic-Laminate Faced Countertops

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; International Surface Fabricators Association; 2013.

C. ISFA 3-01 - Classification and Standards for Solid Surfacing Material; International Surface Fabricators Association; 2013.

D. MIA (DSDM) - Dimensional Stone Design Manual; VII, 2007.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.05 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

A. Quality Standard: See Section 06 4100.

   1. Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

   2. Provide labels and certificates from AWI certification program indicating that countertops, including installation, comply with requirements of grades specified.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and

capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
a. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
b. Color and Pattern: Quiet Swirl 9241SS
c. Manufacturers:
1) Wilsonart: www.wilsonart.com
3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

C. Plastic-Laminate Faced Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Grade: Premium.
2. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS1.
a. Finish on Exposed Surfaces: Traceless Ultra Matte, gloss rating of 5 to 20.
b. Color and Pattern: Nile Velvet 15515
c. Manufacturers:
1) Wilsonart: www.wilsonart.com.
3. Core Thickness: 3/4 inch (12 mm), minimum.
a. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
4. Exposed Edge Treatment: As indicated
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
6. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.
7. Paper Backing: Provide paper backing on underside of countertop substrate.

2.02 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.

3.03 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.04 CLEANING

A. Clean countertops surfaces thoroughly.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 26 0500

ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical work is indicated on drawings and/or specified in Divisions 26, 27 and 28 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

	ITEM	SECTION
1.	Electrical General Provisions	26 0500
2.	Electrical Submittals and Spare Parts	26 0502
3.	Electrical Connections for Equipment	26 0507
4.	Conductors and Cables	26 0519
5.	Grounding	26 0526
6.	Supporting Devices	26 0529
7.	Conduit Raceway	26 0532
8.	Electrical Boxes and Fittings	26 0533
9.	Electrical Seismic Control	26 0548
10.	Electrical Identification	26 0553
11.	Occupancy Sensors	26 0923
12.	Wiring Devices	26 2726
13.	Overcurrent Protective Devices	26 2815
14.	Demolition	26 4119
15.	Interior and Exterior Building Lighting	26 5100
16.	Stage Lighting and Dimming System	26 5561
17.	Telephone Data Systems	27 1500
18.	Audiovisual Systems	27 4100
19.	Fire Alarm and Detection System	28 3111

B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.

C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 DEFINITION OF TERMS

A. The following terms used in Divisions 26, 27 and 28 documents are defined as follows:

1. "Provide": Means furnish, install and connect, unless otherwise indicated.
2. "Furnish": Means purchase and deliver to project site.

© BNA Consulting

3. "Install": Means to physically install the items in-place.
4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.4 RELATED SECTIONS:

A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 26, 27 and 28 sections.

C. Miscellaneous Metal Work:

1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.

D. Miscellaneous Lumber and Framing Work:

1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.

E. Moisture Protection:

1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. See Division 7, Thermal and Moisture Protection for material and installation requirements.

F. Access panels and doors:

1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.

G. Painting:

1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:

1. Electric motors.
2. Package mechanical equipment: fans, fan coil units, pumps, boilers, duplex compressors, etc.
3. Flow switches and valve monitors.
4. Motorized dampers.
5. Fire and smoke dampers
6. Duct mounted smoke detectors.
7. Door hold-open/release devices.
8. Electric hardware.
9. Temperature control panels.
10. Display cases.

© BNA Consulting

11. Water coolers.

1.6 WORK NOT INCLUDED IN THIS DIVISION:

A. Items of work provided under another contract include, but are not necessarily limited to, the following:

1. Telephone cables and electronic equipment.
2. Data system cables, fittings, coverplates and electronic equipment.
3. Control wires for irrigation control valves.
4. Energy management/temperature control system; both line and low voltage including conductors and conduit.
5. Television monitors and projection equipment.
6. Security system equipment, cables, fittings, and coverplates.
7. CCTV cabling and electronic equipment.
8. MATV cabling and electronic equipment

1.7 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.8 REQUESTS FOR INFORMATION (RFIs):

A. Contractor shall review all Contract Documents thoroughly before submitting an RFI to avoid unnecessary questions and ensure the question has not already been addressed within the existing Contract Documents.

B. RFIs should be used to seek clarification on issues or areas of confusion that cannot be resolved through a review of the Contract Documents.

C. Each RFI shall contain the following:

1. Description of the Issue/Question: Clearly detail the issue or confusion, referencing the related Contract Document drawings and/or specifications.
2. Relevant Documents: Attach any necessary supporting documents that could aid in understanding the RFI.
3. Proposed Solution: Suggest a possible resolution to the problem or confusion.

D. Non-Compliant RFIs

1. Frivolous or incomplete RFIs will not be accepted. RFIs that do not follow the guidelines set forth in this section, or are deemed unnecessary, may be returned without response at the discretion of the Engineer.

1.9 QUALITY ASSURANCE:

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.

© BNA Consulting

B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. National Electric Code (NEC).
2. International Building Code (IBC).
3. International Fire Code (IFC).
4. International Mechanical Code (IMC).

C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.

1.	UL	Underwriters' Laboratories
2.	ASTM	American Society for Testing Materials
3.	CBN	Certified Ballast Manufacturers
4.	IPCEA	Insulated Power Cable Engineers Association
5.	NEMA	National Electrical Manufacturer's Association
6.	ANSI	American National Standards Institute
7.	ETL	Electrical Testing Laboratories

D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents that may be in excess of the aforementioned requirements, and not contrary to same.

F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.

G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.10 CONSTRUCTION CHANGE ORDER PROPOSALS

A. In the event that a submission of a change order is issued by the contractor, the following information will be required to be submitted by the contractor, prior to any consideration by the owner/architect.

a. Where project manager or project engineer work is required, the labor cost shall not exceed 2% of the electrical portion of the change order.

b. All equipment, including conduit and wire, shall be itemized, identifying unit costs and quantities of equipment. Distributor quotes shall accompany all change order requests. The distributor quotes shall include costs for all equipment including conduit and wire. Lot pricing for equipment is not acceptable.

c. The general contractor shall review and confirm that the quantity and costs of materials submitted appear reasonable for the scope proposed.

© BNA Consulting

d. Labor units shall not exceed base NECA #1 standards. No adjustment factors shall be approved.
e. Any research and labeling time, shall be the responsibility of the electrical contractor and shall not be included in the change order request.
f. Any costs associated with the purchase of tools or transportation shall be fully itemized for review by architect/owner.
g. Overtime rates shall only be approved where additional manpower cannot achieve the same result.
h. Change order form shall follow the following format:
    i. PCO number
    ii. Detailed description of work being performed
    iii. Location on project where work is performed
    iv. Chosen NECA column
    v. Identified material:
        1. QTY
        2. Unit cost
        3. Mark up
        4. Material total
    vi. Identified labor:
        1. QTY
        2. Unit cost
        3. Composite labor rate
        4. Labor total

1.11 RECORD DRAWINGS:

A. Contractor shall provide as-built drawings and a record model of the completed project, reflecting all deviations from the original design including but not limited to field conditions, RFIs, ASIs, and other modifications. The as-built drawings shall be provided in both Autodesk Revit and PDF formats.

B. Maintain, on a daily basis, a complete set of “Record Drawings”, reflecting an accurate record of work in accordance with the following:

1. Show the complete routing and location of all feeders rated 100 amps and larger. Contractor shall clearly indicate dimensions on the drawings for work that is hidden beneath the ground or under slabs, concealed above ceiling structures, and within concealed spaces. These dimensions shall be measured from fixed structural elements, rather than from partition walls or other non-structural elements.
2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Contractor shall clearly indicate dimensions on the drawings for work that is hidden beneath the ground or under slabs, concealed above ceiling structures, and within concealed spaces. These dimensions shall be measured from fixed structural elements, rather than from partition walls or other non-structural elements.
3. Show all changes, deviations, addendum items, change orders, job instructions, etc., that change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.
4. Provide a copy of the raceway as-builts within the equipment rack for the system indicated below. Provide 11x17 size laminated prints that are legible.
    a. Telecommunications
    b. Audiovisual

C. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work

© BNA Consulting

without written authorization for such changes.

D. The Architect/Engineer shall review the drawings and the Contractor shall incorporate the resulting comments into the final record drawings.

E. Certify the “Record Drawings” for correctness by placing and signing the following certifications of the first sheet of the drawings:

"CERTIFIED CORRECT (3/8" high letters)

(Name of General Contractor)

By: _____ Date: _____

(Name of Electrical Contractor)

By: _____ Date: _____

1.12 GUARANTEE:

A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials that develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

1.13 OTHER:

A. Right to Hire. “Client” agrees that during the project and for a period of twenty four (24) months following substantial completion that it will not, directly or indirectly, employ or solicit to employ BNA Personnel.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.

B. Any conflict arising from the use of substituted equipment shall be the responsibility of the

© BNA Consulting

Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.

C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.

E. Provide only equipment specified in the Contract Documents or approved by addendum.

2.3 SPARE PARTS:

A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.

B. Provide equipment enclosures appropriate to the environment to which they are installed. For example, provide NEMA 3R for exterior enclosures and NEMA 1 for interior enclosures unless otherwise noted.

C. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.

D. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.

E. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.

F. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.

G. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.

B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

© BNA Consulting

3.3 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.

B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.

C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 FIRE PENETRATION SEALS:

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling that it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M CID cast-in device for floor slabs. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.6 PROJECT FINALIZATION AND START-UP:

A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.

B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.

C. The Factory Representative and/or System Subcontractor shall give personal instruction on operating and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

1. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.
2. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

SYSTEM	FACTORY REPRESENTATIVE
(List systems included)	(List name and address of Factory Representative)

Owner's Representative	Contractor

© BNA Consulting

D. Send copy of acceptance to Architect/Engineer.

3.7 FINAL REVIEW:

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 26 0500

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 0502

ELECTRICAL SUBMITTALS, O & M MANUALS AND SPARE PARTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to all Division 26, 27 and 28 sections.

B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.

C. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 SUBMITTAL REQUIREMENTS:

A. GENERAL:

1. After the Contract is awarded but prior to ordering, manufacture, or installation of any equipment, prepare complete Submittals including shop drawings, product data, brochures, etc. for materials and equipment as required by each section of the specification.
2. Review of Submittals shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.
3. Submittals are reviewed, not approved. Comments made within submittals do not alter the contract documents in any way. The contractor is still responsible, regardless of comments (if any) made within submittals, for complying with drawings and specifications.
4. Notify engineer in writing if any of the comments noted in the submittals alter the contract cost. A comment within the submittal process which increases/decreases cost of product is not an authorization to the contractor under any circumstances to proceed.
5. Notify engineer of any modifications between contract documents and submittals. It is the responsibility of the contractor to ensure compliance.
6. ELECTRONIC SUBMITTAL REQUIREMENTS:
   a. Provide submittals in Portable Document Format (PDF).
   b. Documents must be electronically bookmarked by Division e.g. 26, 27 and 28, Specification section e.g. 26 0510 and individually for each item submitted for light fixtures, switchgear, transformer, panelboard etc. and keyword searchable using Adobe Acrobat (http://www.adobe.com/acrobat) or Bluebeam Revu (http://www.bluebeam.com) for each relevant section.
   c. Electronically highlight all options for light fixtures, electrical equipment, etc. Manual highlighting and scanning of the documents is NOT acceptable and will NOT be reviewed.

d. Provide only completed cutsheets for all fixture and equipment types. Blank cutsheets submitted with a schedule are NOT acceptable and will NOT be reviewed.

e. At the time of submission, the electrical contractor shall provide a complete and comprehensive submission of all required specification sections/shop drawings at the same time. Exceptions may be given, with prior approval, for time-sensitive equipment.

f. A maximum of one submittal per specification section is allowed. It is NOT acceptable to provide a product by product submittal. Single product by product submittals will NOT be reviewed.

B. SCHEDULING

1. GENERAL

a. A minimum period of two weeks, exclusive of transmittal time, will be required each time Submittals are submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data.

b. If the shop drawings are rejected twice, the contractor shall reimburse the engineering firm the sum of $1,200.00 for the third review and any additional reviews required prior to the commencement of additional review.

C. QUALITY ASSURANCE

1. PRE-SUBMITTAL PREPARATION

a. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to ensure proper clearance for installation of equipment.

b. Shop drawings requiring the use of electronic documents (floor plans, Lighting plans, fire alarm plans, etc.) shall be requested via a request for information (RFI) through the general contractor. Electronic documents will be provided to the Architect for distribution. No direct vendor requests will be accepted.

c. Contractor is completely responsible for the content of the submittal

2. SUBMITTAL REQUIREMENTS

a. Provide a stamp or statement on each submittal as follows:

i. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Name_____.

Position_____Date_____

i. Failure to provide certification will result in submittals being rejected and returned without review.

b. Brochures to be submitted as supplementary information shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs that describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is

clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

c. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

d. Observe the following rules when submitting the Shop Drawings and Brochures.

i. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be rejected and returned without being reviewed.

1. Submittal Identification shall include the following:

a. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted.

b. Original submittal numbers shall have the following format: “XXX-Y;” where “XXX” is the originally assigned submittal number and “Y” is a sequential letter assigned for resubmittals (for example, A, B, or C being the first, second, and third resubmittals, respectively). Submittal 25B, for example, is the second resubmittal of Submittal 25.

D. POST-SUBMITTAL

1. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents.

1.3 PROVIDE SUBMITTALS AS REQUESTED FOR EACH OF THE SECTIONS LISTED BELOW:

A. 26 0519 Conductors and Cables

1. (600V and Below)

a. Submit megohmmeter test data for circuits under 600 volts. Megger all circuits of 100 amp and greater rating.

B. 26 0526 Grounding

1. Submit the name of test agency to be used for testing specified in this section. Submit results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.

C. 26 0532 Conduit Raceway

1. Submit manufacturer’s data on MC-PCS Power & Control/Signal Cable.

D. 26 0533 Electrical Boxes and Fittings

1. Submit manufacturer’s data including specifications, installation instruction and

general recommendations for each type of floor box used on project.

E. 26 0548 Electrical Seismic Control

1. A single submittal shall be provided for all seismic anchorage and restraints for all Division 26 equipment and systems provided as part of this project. Individual submittals for specific systems will not be accepted.

2. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

a. Complete engineering calculations and shop drawings for all seismic requirements for all equipment to be restrained as outlined in Section 26 0548 Specification, and as detailed on drawings.

b. The professional seal of the engineer who is responsible for the design of the Seismic Restraint System.

c. Details for all seismic bracing.

d. Details for steel frames, concrete inertia bases, and housekeeping pads. Include dimensions, embed depths, dowelling details, and concrete reinforcing requirements.

e. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors, snubbers, cables, and bolt connections.

f. Floor plan noting the locations, size, and type of anchorage and restraint to be used.

g. Include confirmation that all calculations are based on the design criteria listed in appropriate Section.

h. Certificate of Compliance.

i. Where equipment is exempt per this specification provide a written certificate of compliance for each of the systems noted with the professional seal of engineer who has reviewed the electrical system.

F. 26 0553 Electrical Identification

1. Submit manufacturer’s data on each type of electrical identification products

a. Submit one sample of each component of the electrical identification system as follows: Wire/cable tape marker, Tags, Engraved, plastic laminate labels, Arc-flash hazard labels

G. 26 0923 Occupancy Sensors

1. Submit manufacturer's data on occupancy sensors, control modules, wiring diagrams, instructions for installation, interconnection diagrams and any related accessories.

2. Submit scaled drawings with lighting fixtures shown and sensor equipment/devices clearly marked by manufacturer showing proper product, location, coverage pattern and orientation of each sensor.

H. 26 2726 Wiring Devices

1. Submit manufacturer's data on electrical wiring devices.

I. 26 2815 Overcurrent Protective Devices

1. Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

2. Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.

3. Submit time-current trip curves (in log-log format) and trip setting parameter/range information (for each trip function) for all solid-state circuit breakers.

4. Manufacturer shall also provide recommended trip settings with the shop drawing submittal (including ground fault settings) for coordination with downstream overcurrent devices. Manufacturer shall base recommendations on the AIC rating of the electrical equipment.

J. 26 5100 Interior and Exterior Building Lighting

1. Submit manufacturer's data on interior and exterior building lighting fixtures.

2. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in PDF format with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with each “type” individually bookmarked, with proposed fixture catalog number and accessories clearly indicated on each sheet.

3. When applicable submit standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be delayed until color samples are provided.

4. Submit ballast and/or driver manufacturer cut sheets.

5. Submit a list of all lamps used on projects.

K. 26 5561 Stage Lighting and Dimming System

1. Submit manufacturer's data on stage lighting and dimming systems, including, but not limited to, dimmer racks, control consoles, lighting instruments, connector strips, receptacles, instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals.

2. Submit dimensioned drawings of stage lighting and dimming system components and accessories. Show accurately scaled layouts of system components. Provide wiring diagrams for inter connection of system components.

L. 27 4100 Audiovisual Systems

1. Provide a list of finish options for selection. Do not order any equipment if finishes have not been selected on the shop drawings.

2. Provide shop drawings for 27 4100 at the time of original shop drawing submission. Do not order AV equipment from the first submission. One hundred and twenty (120) days prior to the time of AV equipment installation, provide a second submission of AV equipment only. Provide current equivalent if specified model has been discontinued.

3. The following items shall be included in the shop drawings submittal:

a. Project manager’s written proof, with signature and date, that shop drawings and/or brochure has been checked for accuracy prior to submittal. Shop drawings to comply in all respects with the requirements of the contract drawings and specifications for this project.

b. A complete bill of materials, broken out per system type, for all components, accessories and hardware to be provided in order to assemble a complete and working system as described within the contract documents.

i. The bill of material is intended to be used to verify equipment within each system. Only one cut sheet per unique product type is required.

ii. Example several systems may require the same flat panel display mount, that mount should be listed in each system type with only one (1) cut sheet provided for that product.

c. Manufacturer's data sheets and installation details for all devices, plates, cables and similar equipment. Product data showing multiple options, products and/or models shall be clearly marked identifying the specific options, products and/or models being provided.

d. Signal flow drawings showing all audio, video, control, network and power connections required between all pieces of equipment within each system.

i. Unique cable/wire identifier for each connection that correspond to field cabling labelling scheme.

ii. All connections require connector type and male/female termination to be identified. Type shall correspond to a connector legend or shall be clearly identified per instance.

iii. Wiring pinouts for all multipin connectors used

iv. Detailed panel drawings showing wall, floor, rack, etc. input/output panel dimensions, connector types and text labeling for each connection shown

v. Physical location information for each device.

vi. Upon request AV Consult's signal flow drawings may be utilized for signal flow documentation within the shop drawings, provided, the items above are included. Contractor shall make request for electronic files as indicated in section 1.2.C.

e. Equipment rack elevations.

f. Matrix routing and preset configuration tables, and digital signal processing configuration details.

g. Wireless microphone transmission frequencies.

h. Submit all manufacturer training, 3rd party and/or organization certificates for each equipment and/or systems required for the implementation of this specification.

4. All touch panel layouts, page logic functions and control system functionality, shall be submitted and approved by the Owner and AV Consultant prior to installation and programming of the control systems. Contractor shall submit the following information at the following stages during the construction of the GUI.

a. Draft Stage: Draft drawings and/or sketches of; basic layouts, button details, text details and page flip progression. Include control schemes for all applicable devices in system.

b. Intermediate Stage: Intermediate Touch Panel Menus designed with manufacturer's software. Submit printouts and/or software files for review. Include detailed layouts, extensive control schemes for all controlled components, comprehensive button and text configurations, page flips and pop-up progression. Incorporate any changes or comments from previous stage mentioned above.

c. Demo Stage: Provide an active Touch Panel and controller to extensively demonstrate the operation of the control system. Demo of system shall be subject for review and considered as a deliverable. Include all revised detailed layouts, extensive control schemes for all controlled components, comprehensive button and text configurations, page flips and pop-up progression. Incorporate any changes or comments from the previous stage mentioned above.

d. Final Stage: Submit Final Touch Panel Menus designed with manufacturer's software. Submit printouts and software files for review.

Include all detailed layouts, all revised control schemes for all controlled components, revised button and text configurations, page flips and pop-up progression. Include final page configurations for control of system from the touch panel. Incorporate any and all changes or comments from the previous stage mentioned above.

M. 28 3111 Fire Alarm and Detection System

1. Submit manufacturer's data on fire alarm and detection systems including, but not limited to, roughing-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals.

2. Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm and detection system. Include wiring diagrams and riser diagrams of panel. Provide dimensioned drawing of Fire Alarm Control Panel and Building Graphic. Shop drawings shall be prepared by an individual with a minimum NICET III (Fire Protection Engineering Technology/Fire Alarm Systems) certification. The individual’s name and certification number shall be shown on the submittal design drawings.

3. Submit a written statement to the Architect and the state and local Fire Marshal's Office that each device of the fire alarm system will be installed, inspected and tested in accordance with applicable requirements of NFPA Standard 72.

4. A complete set of shop drawings indicating:

   a. Location of all alarm-initiating and alarm-signaling devices.

   b. Point-to-point wiring diagrams for all alarm-initiating and alarm-signaling devices.

   c. Standby battery calculations, including voltage drop calculation.

5. Wiring diagrams for:

   a. Alarm control panels.

   b. Auxiliary function relays and solenoids.

   c. Remote signaling equipment.

6. A complete equipment list identifying:

   a. Type

   b. Model

   c. Manufacturer

   d. Manufacturer catalog data sheets

   e. UL Listing and/or FM approval showing compatibility of device with Fire Alarm Control Panel (FACP)

7. A complete zone list identifying all:

   a. Alarm-initiating and alarm-signaling devices.

   b. Remote signaling and auxiliary function zones.

   c. Specific devices associated with each zone.

8. Submit to State and Local Fire Marshall, a complete Certificate of Compliance

1.4 OPERATION & MAINTENANCE MANUALS

A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.

B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or

volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones WLJ36544B). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.

C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).

D. Include the following information where applicable.

1. Identifying name and mark number.
2. Certified outline Drawings and Shop Drawings.
3. Parts lists.
4. Performance curves and data.
5. Wiring diagrams.
6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
7. Manufacturer's recommended operating and maintenance instructions.
8. Vendor's name and address for each item.

E. The engineer shall review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of $1,200.00 for each review afterwards.

F. Provide Operation and Maintenance Manual information for each section listed below in addition to the general requirements listed above.

1. 26 0548 Electrical Seismic Control
   a. Certificate of Compliance from Final Inspection
2. 26 0923 Occupancy Sensors
   a. Record Drawings
      i. A complete set of ‘as-builts’ drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.
      ii. Provide a CD to the owner containing the information specified below. The CD shall include all information required to allow the Owner to change the schedules themselves. The CD shall contain a minimum of following:
         1. CAD drawing files of ‘as-built’ lighting control components and point to point connections.
         2. General configuration programming.
         3. Job specific configuration programming to include schedule.
         4. Tutorial file on complete programming of lighting control system.
3. 27 4100 Audiovisual System
   a. Manual Requirements
      i. Operating and maintenance manuals shall be submitted prior to testing of system. Total of two (2) manuals, shall

be delivered to the Company. Manuals shall include all model numbers, service, installation, and programming information.

ii. Include all the following information:

1. Warranty
2. Network settings
3. Riser diagrams from Shop drawings
4. Training videos
5. USB Flash drive with programing source code and software editing programs

b. Record Drawings

i. The Owner shall provide electronic (DWG) format of AV System system drawings that as-built construction information can be added to. These documents will be modified by the AV contractor to denote as-built information as defined above and returned to the Owner.

ii. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.

4. 28 3113 Fire Alarm and Detection System

a. Manual Requirements

i. Operating and maintenance manuals shall be submitted prior to testing of the system. Manuals shall include all service, installation, and programming information.

b. Record Drawings

i. A complete set of CAD "as-built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system. Vendor shall not request drawings from the Engineer. Vendor shall request current architectural drawings from the Architect and include all cost with bid.

ii. A building map shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building fire alarm map adjacent to the fire alarm panel and all remote operating panels. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD fire alarm drawing. Edges of the sign shall be colored to match the building interior. The building map shall indicate the various devices and wiring by the use of different colors (minimum of five colors).

iii. Provide a CD to the Owner containing the information

specified below. The CD shall include all information required to allow the Owner to change the fire alarm program themselves. The CD shall contain a minimum of the following:

1. CAD drawing files of building fire alarm map.
2. CAD drawing files of as-built fire alarm components and point to point connections.
3. General configuration programming.
4. Job specific configuration programming.
5. Tutorial file on complete programming of fire alarm system

1.5 SPARE PARTS:

A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Stock of all spare items shall be delivered as directed to Owner's storage space prior to substantial completion. All components shall be labeled to match construction document nomenclature.

B. Review with Owner/Architect and revise as needed for each project.

Section	Section Name	Description	Qty. Required	Qty. Received	Fulfilled?
26 0923	Occupancy Sensors	Spare sensors for each type used on project.	5 per type		
26 5100	Interior and Exterior Building Lighting	Spare diffusers (acrylic and/or glass only) for each fixture type. One set shall be provided per fixture type and one additional per every (10) fixtures of each type; quantity shall not exceed (10) spares for any single fixture type.	Per description		
		Provide a complete spare parts list in lighting shop drawing review			

END OF SECTION 26 0502

SECTION 260507

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-23 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.

B. Refer to Division-23 sections for motor starters and controls furnished integrally with equipment; not work of this section.

C. Refer to Division-23 section for control system wiring; not work of this section.

D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.

B. UL LABELS: Provide electrical connection products and materials that have been UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GENERAL:

A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 26 0532, Conduit Raceways; Section 26 2726 Wiring Devices: and Section 26 0519 Conductors and Cables for additional requirements. Provide final connections for equipment consistent with the following:

1. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.
2. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).
3. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

© BNA Consulting

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Verify all electrical loads (voltage, phase, horse power, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, **by reviewing respective shop drawings furnished under each division**. **Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics.** Report any variances from electrical characteristics noted on the electrical drawings to Architect **before proceeding** with rough-work. In summary it is not in the Electrical Engineers scope to review the shop drawings from other trades/divisions.

E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.

F. Refer to basic materials and methods Section 26 0553 Electrical Identification, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 26 0507

© BNA Consulting

SECTION 26 0519

CONDUCTORS AND CABLES (600V AND BELOW)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors (600V)

C. Applications for conductors and cables required for project include:

1. Feeders
2. Branch Circuits
3.

1.3 RECORDS SUBMITTAL: Refer to Section 26 0502 for requirements.

1.4 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables that have been UL-listed and labeled.

B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.

C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.5 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V):

A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger – Copper conductor; see drawings for insulation type.
2. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide solid conductors for #10 AWG and smaller. Provide stranded conductors for #8 AWG and larger.

B. Provide a maximum of three phase conductors in any one conduit or as approved by electrical engineer. Where phase conductors share a common neutral they must have a

means to simultaneously disconnect all ungrounded conductors at the point where the branch circuits originate. The ungrounded and neutral conductors of a multi-wire branch circuit must be grouped together by wire ties at the point of origination.

C. Provide neutral and ground wire as specified elsewhere in documents.

D. Provide separate neutral conductor for all single phase branch circuits installed. No shared neutrals are allowed. Neutral conductor shall be the same size as the phase conductor.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.

B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.

C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop that pull wires can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.

E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.

F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.

G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.

H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and that is listed by UL.

I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.

J. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Record all test data and provide written test report.

B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.

© BNA Consulting

3.3 IDENTIFICATION OF FEEDERS: Refer to Section 26 0553 for requirements.

END OF SECTION 26 0519

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 0526

GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Provide grounding as specified herein, and as indicated on drawings.

B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.

C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.

D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.

E. Types of grounding in this section include the following:

1. Grounding Electrodes
2. Grounding Rods
3. Separately Derived Systems
4. Service Equipment
5. Enclosures
6. Systems
7. Equipment
8. Other items indicated on drawings

F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products that have been UL listed and labeled.

B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete

© BNA Consulting

installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

B. ELECTRICAL GROUNDING CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. Provide with green insulation.

C. INSULATED GROUNDING BUSHINGS: Plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners, OZ-Gedney BLG, or Thomas & Betts #TIGB series.

D. CONNECTIONS TO PIPE: For cable to pipe, OZ-Gedney G-100B series or Thomas & Betts #390X series, or Burndy type GAR.

E. CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES: For splicing and/or connecting conductors, use exothermic welds or high pressure compression type connectors. Provide exothermic weld kits manufactured by Cadweld or Thermoweld. If high compression type connectors are used for cable-to-cable, or cable-to-steel, or cable-to-ground rod connections, provide Thomas & Betts #53000 series, or Burndy Hyground series.

F. BONDING JUMPERS: OZ-Gedney Type BJ, or Thomas & Betts #3840 series, or Burndy type GG and type B braid.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.

B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.

C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All raceways shall include copper grounding conductor sized in accordance with NEC.

D. Provide grounding conductors for dimming systems in accordance with manufacturer's requirement.

3.2 GROUNDING ELECTRODES:

A. GROUNDING ELECTRODE CONDUCTOR: Provide grounding electrode conductor sized per NEC table 250-94 or as indicated.

B. Run main grounding conductors exposed or in metallic conduit if protection or concealment is required.

C. EQUIPMENT BONDING/GROUNDING: Provide a NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
2. Distribution feeders.
3. Motor and equipment branch circuits.
4. Device and lighting branch circuits.
5. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.

D. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system.

© BNA Consulting

E. Provide bonding wire in all flexible conduit.

3.3 TESTING:

A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section.

B. Include typewritten records of measured resistance values in the Operation and Maintenance Manual.

C. Use independent testing agency for all testing.

D. Use test equipment expressly designed for the purpose intended. Submit name of testing agency for review and approval, in writing, to the Engineer prior to the performance of any testing.

END OF SECTION 26 0526

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 0529

SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-26 sections. See Section 260532, Raceways, for additional requirements.

B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components that are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. GENERAL:

1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

© BNA Consulting

D. RACEWAYS:

1. Support raceways that are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90° degree bend. Support raceway (as it is installed) in accordance with the following:

NUMBER OF RUNS	3/4" TO 1-1/4" 0	1-1/2" & LARGER 0
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use independent support wires as a portion of any raceway support system; do not support raceway from ceiling support wires.

E. FLOOR MOUNTED EQUIPMENT:

1. Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers (provide neoprene vibrations isolators at anchor points), oil switches, battery packs and racks, and similar equipment furnished under Division 26, 27 and 28.

END OF SECTION 26 0529

© BNA Consulting

SECTION 26 0532

CONDUIT RACEWAY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Electrical Metallic Tubing
2. Flexible Metal Conduit
3. Intermediate Metal Conduit
4. Liquid-tight Flexible Metal Conduit
5. Rigid Metal Conduit

1.3 QUALITY ASSURANCE:

A. MANUFACTURERS: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. STANDARDS: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components that have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

C. SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. GENERAL:

1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

B. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.

C. INTERMEDIATE STEEL CONDUIT (IMC): FS WW-C-581.

D. ALUMINUM CONDUIT: Not acceptable.

E. MC CABLE: Not acceptable.

1. The use of MC-PCS cable is acceptable for light fixture whips utilizing 0-10v control schemes, not longer than 72” in length, located above removable grid ceilings. All MC cable shall be provided with anti-short fittings.

a. Acceptable Manufacturers

i. AFC – MC Luminary Cable

© BNA Consulting

ii. Encore – MC-LED Lighting Cable

iii. Southwire – MC-PCS Duo

F. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:

1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

G. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.

H. EMT FITTINGS:

1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.

I. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;

1. Zinc-coated steel.

J. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.

K. LIQUID TIGHT FLEXIBLE METAL CONDUIT:

1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

L. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.

M. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 CONDUIT; TUBING; AND DUCT ACCESSORIES:

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, that mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.3 SEALING BUSHINGS:

A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.4 CABLE SUPPORTS:

A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:

1. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:

a. Install in electric metallic tubing (EMT). Below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in RMC or IMC. In suspended slabs, install in PVC. Encase non-metallic duct 40-amp circuits, 1-1/4" and larger in concrete. See duct banks.

B. Coordinate with other work including metal and concrete deck work, as necessary to

© BNA Consulting

interface installation of electrical raceways and components.

C. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.
2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.
3. Provide a minimum of 1 ½" from nearest surface of the roof decking to raceway.
4. Provide a maximum of three phase conductors in any one conduit or as approved by electrical engineer. Where phase conductors share a common neutral they must have a means to simultaneously disconnect all ungrounded conductors at the point where the branch circuits originate. The ungrounded and neutral conductors of a multi-wire branch circuit must be grouped together by wire ties at the point of origination.
5. Provide neutral and ground wire as specified elsewhere in documents.
6. Provide separate neutral conductor for all single phase branch circuits installed. No shared neutrals are allowed. Neutral conductor shall be the same size as the phase conductor.

D. Comply with NEC for requirements for installation of pull boxes in long runs.

E. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandrel and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

F. Replace all crushed, wrinkled or deformed raceway before installing conductors.

G. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

H. Install spare 3/4" conduits (capped) from each branch panelboard into the ceiling and floor space. Run five into the ceiling space and five into the floor space. Where the floor is not accessible run six conduits into the ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.

I. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.

J. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.

K. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

L. Electrical Identification: Refer to Section 260553 for requirements.

M. SPARE PARTS: Refer to Section 26 0502 for requirements.

END OF SECTION 26 0532

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 0533

ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to electrical wiring boxes and fittings specified herein. See Section 260532, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Conduit Bodies
5. Bushings
6. Locknuts
7. Knockout Closures
8. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings that have been UL-listed and labeled.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. INTERIOR OUTLET BOXES:

1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x2-1/8".
2. Provide an 'FS' box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, that are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.

© BNA Consulting

C. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

D. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

F. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
3. Provide coverplates for all boxes. See Section 262726, Wiring Devices.
4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
5. Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.
7. Fasten boxes rigidly to substrates or structural surfaces, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them. Set boxes on opposite sides of fire resistant walls with minimum of 24” separation.
8. Provide a minimum of 1 ½” from the nearest surface of the roof decking to the installed boxes.
9. Provide electrical connections for installed boxes.

END OF SECTION 26 0533

© BNA Consulting

SECTION 26 0548

ELECTRICAL SEISMIC CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Anchorage and seismic restraint systems for all Division 26 isolated and non-isolated equipment, cable tray, and conduit systems.

B. Anchorage and seismic restrain systems for electrical components shall include but not be limited to the following:

1. Conduit
2. Light Fixtures

1.2 RELATED WORK:

A. Requirements: Provide Electrical Seismic Control in accordance with the Contract Documents.

B. Section 260500 – Electrical General Provisions

1.3 REFERENCES:

A. International Building Code, Current Edition in use by Jurisdictional Authority.

B. NFPA Bulletin 90A, Current Edition.

C. UL Standard 181.

D. ASCE 7-10

1.4 SYSTEM DESCRIPTION

A. The Division 26 Contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with the following:

1. Short period design spectral response acceleration coefficient SDS=0.70.
2. One second period design spectral response acceleration coefficient SD1=0.28.
3. Site Class B.
4. Seismic Design Category D.
5. Importance Factor (Ip) = 1.0

B. Seismic Restraint Exceptions

1. The following components are exempt from the requirements of this section

1.5 QUALITY ASSURANCE:

A. All supports, hangers, bases, anchorage and bracing for all isolated equipment and non-isolated equipment shall be designed by a professional engineer licensed in the state where the project is located, employed by the restraint manufacturer, qualified with seismic experience in bracing for electrical equipment. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal. All calculations/design work required for the seismic anchorage and restraint of all Division 26 equipment and systems shall be provided by a single firm.

B. The above qualified seismic engineer shall determine specific requirements for equipment anchorage and restraints, locations and sizes based on shop drawings for the electrical equipment that have been submitted, reviewed and accepted by the Architect/Engineer for this project.

C. Seismic Engineer or the Engineer's Representative shall field inspect final installation and certify that bracing and anchorage are in conformance with the Seismic Engineer's design. A certificate of compliance bearing the Seismic Engineer's signed Professional Engineer's seal shall be submitted and shall be included in each copy of the Operation and Maintenance Manuals.

D. The Division 26 Contractor shall require all equipment suppliers furnish equipment that meets the seismic code, with bases/skids/curb designed to receive seismic bracing and/or anchorage. All isolated and non-isolated electrical equipment bracing to be used in the project shall be designed from the Equipment Shop Drawings and certified correct by the equipment manufacturer for seismic description listed in Paragraph 1.4 above, with direct anchorage capability.

1.6 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS:

2.1 RESTRAINT EQUIPMENT AND SYSTEMS:

A. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

1. Mason Industries, Inc.
2. Korfund
3. Amber/Booth Company
4. Vibration Mountings and Control Company
5. Kinetics
6. International Seismic Application Technology
7. Tolco

B. Manufacture and design of restraints and anchors for isolated equipment shall be by the manufacturer of the vibration isolators furnished for the equipment.

2.2 SNUBBERS:

A. Snubbers shall be all-directional and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.

B. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch or more than 1/4 inch.

C. Snubbers shall be Mason Industries Z -1011 or accepted equivalent.

PART 3 – EXECUTION

3.1 DESIGN AND INSTALLATION:

A. General:

1. All electrical components shall be braced, anchored, snubbed or supported to withstand seismic disturbances in accordance with the criteria of this specification. Provide all engineering, labor, materials, and equipment for protection against seismic disturbances as specified herein. The following electrical components are exempt from seismic restraint requirements.
   a. Electrical components in Seismic Design Category A or B (see section 1.4)
   b. Electrical components in Seismic Design Category C provided that the component importance factor, I_p, is equal to 1.0 (see section 1.4).
   c. Electrical components in Seismic Design Categories D, E, or F where all of the following apply:

i. The component importance factor, I_p, is equal to 1.0;

ii. The component is positively attached to the structure;

iii. Flexible connections are provided between the component and associated ductwork, piping, and conduit; and either

1. The component weighs 400 lb (1,780 N) or less and has a center of mass located 4 ft (1.22 m) or less above the adjacent floor level; or

2. The component weighs 20 lb (89 N) or less or, in the case of a distributed system, 5 lb/ft (73 N/m) or less.

2. Powder-actuated fasteners (shot pins) shall not be used for component anchorage in tension applications in Seismic Design Category D, E, or F.

3. Attachments and supports for electrical equipment shall meet the following provisions:

a. Attachments and supports transferring seismic loads shall be constructed of materials suitable for the application and designed and constructed in accordance with a nationally recognized structural code such as, when constructed of steel, AISC, Manual of Steel Construction (Ref. 9.8-1 or 9.8-2).

b. Friction clips shall not be used for anchorage attachment.

c. Expansion anchors shall not be used for electrical equipment rated over 10 hp (7.45 kW). Exception: Undercut expansion anchors.

d. Drilled and grouted-in-place anchors for tensile load applications shall use either expansive cement or expansive epoxy grout.

e. Supports shall be specifically evaluated if weak-axis bending of light-gauge support steel is relied on for the seismic load path.

f. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction. The design force shall be taken as 2Fp. The intent is to prevent excessive movement and to avoid fracture of support springs and any non- ductile components of the isolators.

g. Seismic supports shall be constructed so that support engagement is maintained.

B. Light Fixtures

1. Light fixtures, lighted signs, and ceiling fans not connected to ducts or piping, which are supported by chains or otherwise suspended from the structure, are not required to satisfy the seismic force and relative displacement requirements provided they meet all of the following criteria:

a. The design load for such items shall be equal to 1.4 times the operating weight acting down with a simultaneous horizontal load equal to 1.4 times the operating weight. The horizontal load shall be applied in the direction that results in the most critical loading for the design.

b. Seismic interaction effects shall not cause an effect so that the failure of the non-essential component causes a failure of an essential component.

c. The connection to the structure shall allow a 360° range of motion in the horizontal plane.

d. The component is less than 20 lbs and has flexible connections and an importance factor (Ip) equal to 0.

END OF SECTION 26 0548

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Requirements of the following Division 26 Sections apply to this section:

1. "Basic Electrical Requirements".
2. "Basic Electrical Materials and Methods".

1.2 SUMMARY

A. This section includes identification of electrical materials, equipment and installations. It includes requirements for electrical identification components including but not limited to the following:

1. Identification labels for raceways, cables and conductors.
2. Operational instruction signs.
3. Warning and caution signs.
4. Equipment labels and signs.

B. Related Sections: The following sections contain requirements that relate to this section:

C. Division 9 Section "Painting" for related identification requirements.

D. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.3 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code"

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. American Labelmark Co.
2. Calpico, Inc.
3. Cole-Flex Corp.
4. Emed Co., Inc.
5. George-Ingraham Corp.
6. Ideal Industries, Inc.
7. Kraftbilt
8. LEM Products, Inc.
9. Markal Corp
10. National Band and Tag Co.

© BNA Consulting

11. Panduit Corp.
12. Radar Engineers Div., EPIC Corp.
13. Seton Name Plate Co.
14. Standard Signs, Inc.
15. W.H Brady, Co.

2.2 ELECTRICAL IDENTIFICATION PRODUCTS

A. Colored Conduit Systems for raceway identification:
   1. Factory-painted conduit and/or factory-painted couplings and fittings

B. Colored paint for raceway identification:
   1. Use Kwal Paint colors as specified in Part 3 – Execution.

C. Color Adhesive Marking Tape for Raceways, Wires and Cables:
   1. Self-adhesive vinyl tape not less than 3 mills thick by 1" to 2" in width.

D. Wire/Cable Designation Tape Markers:
   1. Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letters.

E. Brass or Aluminum Tags:
   1. Metal tags with stamped legend, punched for fastener.
   2. Dimensions: 2" X 2" 19 gage.

F. Engraved, Plastic Laminated Labels, Signs and Instruction Plates:
   1. Engraving stock plastic laminate, 1/16" minimum thickness for signs up to 20 sq. in. or 8" in length; 1/8 " thick for larger sizes. Engraved legend in 1/4" high white letters on black face and punched for mechanical fasteners.

G. Equipment Labels:
   1. Adhesive backed polyester with self-laminating flap. Chemical, abrasion and heat resistant.
   2. Dimensions: minimum 5" x 2"
   3. Conductor-Identification-Means Labels:
      a. Information contained: the method utilized for identifying ungrounded conductors within switchboards, distribution panels and branch circuit panels.
   4. Source-of-Supply Labels:
      a. Information contained: indicate the device or equipment where the power supply originates.

H. Baked Enamel Warning and Caution Signs for Interior Use:
   1. Preprinted aluminum signs, punched for fasteners, with colors legend and size appropriate to location.

I. Fasteners for Plastic-Laminated and Metal Signs:
   1. Self-tapping stainless steel screws or # 10/32 stainless steel machine screws with nuts, flat and lock washers.

J. Cable Ties:
   1. Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18" minimum width, 50-lb. Minimum tensile strength, and suitable for a temperature range from minus 40° F. to 185° F. Provide ties for specified colors when used for color coding.

© BNA Consulting

PART 3 – EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics:

1. Coordinate names, abbreviations, colors and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

C. Sequence of Work:

1. Where identification is to be applied to surfaces that require a finish, install identification after completion of finish work.

D. Conduit Identification:

1. Identify Raceways of Certain Systems with Color Coding. Acceptable means of color identification are as follows:
   a. Colored adhesive marking tape.
   b. Field-painted colored bands.
   c. Factory-painted conduit.
   d. Color exposed or accessible raceways of the following systems for identification. Make each color band 2 inches wide, completely encircling conduit. Apply bands at changes in direction, at penetrations of walls and floors, and at 20-foot maximum intervals in straight runs. Apply the following colors:
      i. Fire Alarm System: Red
      ii. Sound/IC: Blue
      iii. Telephone: Yellow
      iv. Data: Green
      v. MATV: Black
      vi. Security: Orange
2. Identify Junction, Pull and Connection Boxes.
   a. Code-required caution sign for boxes shall be pressured-sensitive, self-adhesive label indication system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers on outside of cover with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.
3. Label and paint the covers of the systems junction boxes as follows:

SYSTEM	COLOR (ALL COLORS ARE KWAL PAINT)	
Fire Alarm	Red Alert	AC118R
Sound/IC	Neon Blue	7076A
Telephone	Competition Yellow	7225A
Data	Java Green	AC098N
MATV	Flat Black	
Security	Fiesta Orange	AC107Y

E. Conductor Color Coding.

© BNA Consulting

1. Provide color coding for secondary service, feeder and branch circuit conductors throughout the project secondary electrical system as follows:

CONDUCTOR	208Y / 120V System	480Y / 277V System
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Shared/Single Neutral	White	Gray
Neutral A (dedicated)	White w/Black Stripe	Gray w/Black Stripe
Neutral B (dedicated)	White w/Red Stripe	Gray w/Orange Stipe
Neutral C (dedicated)	White w/Blue Stripe	Gray w/Yellow Stipe
Equipment Ground	Green	Green
Isolated Ground	Green w/Yellow Strip	Green w/Yellow Stripe

2. Switch legs, travelers and other wiring for branch circuits shall be of colors other than those listed above.
3. Use conductors with color factory applied the entire length of the conductors except as follows:
   a. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
   b. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
   c. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

F. Power Circuit Identification.

1. Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb monofilament line or one-piece self-locking nylon cable ties.
2. Tag or label conductors as follows:
   a. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicting source and circuit numbers.
   b. Multiple Circuits: Where multiple branch circuits or control wiring or communications/ signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding

© BNA Consulting

or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

G. Apply warning, caution and instruction signs and stencils as follows:

1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items. Warning and caution signs shall be furnished and installed on, but not be limited to the following equipment and locations:

a. Entrances to rooms and other guarded locations that contain exposed live parts 600 volts or less; signs shall forbid unqualified personnel to enter.

b. Switch and Overcurrent device enclosures with splices, taps and feed-through conductors. Provide warning label on the enclosures that identifies the nearest disconnecting means for any feed-through conductors.

c. Entrances to buildings, vaults, rooms or enclosures containing exposed live parts or exposed conductors operating at over 600 volts: DANGER-HIGH VOLTAGE-KEEP OUT.

d. Metal-enclosed switchgear, unit substations, transformers, enclosures, pull boxes, connection boxes and similar equipment operating at over 600 volts shall have appropriate caution signs and warning labels.

e. Indoor and Outdoor substations operating over 600 volts. Provide warning signs, instructional signs and single-line diagrams in accordance with NEC 225.70.

H. Emergency Operating Signs: Install engraved laminated signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

I. Install equipment/system circuit/device identification as follows:

1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/4"-high lettering on 1-inch-high label (1 1/2-inch-high where two lines are required) white lettering in black field. White lettering in red field for Emergency Power Systems. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.

a. Each service disconnect, to identify it as a service disconnect.

b. Panelboards (exterior and interior), electrical cabinets, and enclosures. For subpanels, identify feeder circuit served from.

c. Switches in fusible panelboards shall be labeled. Main switches shall be identified.

d. Access doors and panels for concealed electrical items.

e. Electrical switchgear and switchboards.

f. Motor control centers.

© BNA Consulting

g. Motor starters, including circuit origination, HP, heater size, FLA, and mechanical equipment designation.

h. Disconnect switches.

i. Pushbutton stations.

j. Power transfer equipment.

k. Contactors.

l. Dimmers.

m. Control devices.

n. Transformers.

o. Power generating units, to include transfer switches.

p. Telephone switching equipment.

q. Clock/program master equipment.

r. Call system master station.

s. TV/audio monitoring master station.

t. Fire alarm master station or control panel.

u. Busduct – Label all cable tap boxes, bus plug-in units, etc. with plastic laminate labels designating load served.

v. Variable frequency drives.

w. Lighting Control Equipment.

x. Uninterruptable Power Supply.

J. Post Conductor-Identification-Means labels at locations of switchboards, distribution panels and branch circuit panels. The labels shall identify the color-coding used on ungrounded conductors for each voltage system used on the premises.

K. Apply Source-of-Supply labels on the exterior covers of equipment (except in single- or two-family dwellings) as follows:

1. Each switchboard supplied by a feeder.

2. Each branch circuit panelboard supplied by a feeder.

3. Each disconnect switch serving elevators, escalators, moving walks, chairlifts, platform lifts and dumbwaiters.

4. Each dry type transformer (or primary-side disconnect switch at transformer). If the primary-side disconnect is remote from the transformer, both the remote disconnect and the transformer shall be labeled, and the transformer label shall also indicate the location of the disconnect.

5. Each feeder disconnect, branch circuit disconnect, panelboard or switchboard in a remote building or structure.

6. Each on-site emergency power source, with sign placed at service entrance equipment to comply with NEC 700.

L. The label shall identify the device or equipment where the power supply originates, and the system voltage and phase. For example: Feeder Power Supply for Panel “XX” Originates at Panel “XX” (or Switchboard “XX”, Transformer “XX”, Switch “XX”, etc.); 120/208 volts, 3-phase (or 120/240, 277/480, etc.).

M. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere.

N. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

© BNA Consulting

O. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics: Example; “208V 30A”.

P. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit that the device is connected to: Example; “CKT A-1”

END OF SECTION 26 0553

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 0923

OCCUPANCY SENSORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of occupancy sensor work is indicated by drawings and schedules.

B. Types of occupancy sensors in this section include the following:

1. Dual Technology Wall Switch
2. Dual Technology Wall Switch with Dimming and Daylight Control.
3. Dual Technology Ceiling Sensor w/ Control Pack

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of occupancy sensors. Provide occupancy sensors that have been UL listed and labeled.

B. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, motor loads and any other passive infrared or microwave systems.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER: The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry. Sensors and related relays shall be compatible with the specific lighting types controlled. All sensors shall be of the same manufacturer, mixing brands of sensors is not acceptable.

A. DUAL TECHNOLOGY WALL SWITCH: Where units are indicated provide a sensor that meets the following minimum requirements:

1. Sensor shall utilize PIR (Passive Infrared) to turn on the lights and then PIR or US (Ultrasonic) technologies to keep lights on.
2. Sensor shall incorporate an inrush current limiter circuit to protect the relay contacts.
3. Sensor shall utilize single or dual dry relay contacts for control of the lighting loads. Contractor shall verify requirements in coordination with the drawings.
4. Sensor shall have a self-adjusting time delay, selectable 5, 15 and 30 minutes.
5. Sensor shall have automatic sensitivity adjustment and be microprocessor controlled.
6. Sensor shall have light level sensing 0 to 200 footcandles.
7. Sensor shall have a 180 degree field of view, coverage up to 800 square feet and shall detect 6 inches of hand movement towards the sensor up to 300 square feet; and body motion towards the sensor up to 1000 square feet.
8. Sensor shall be rated for 0 to 800 watts at 120VAC and 0 to 1200 watts at 277VAC.

© BNA Consulting

9. Sensor shall be automatic on and shall have an automatic to off override switch on the unit. Switch shall be equipped with an air gap switch to disconnect power to the lighting load.
10. Sensor shall have real time motion indicator on the front of the unit.
11. Sensor shall mount to a single gang switch box.
12. Subject to compliance with the above requirements. Provide models of one of the following:
    a. Greengate ONW-DT
    b. Sensor Switch WSX PDT Series
    c. Douglas WOS Series

B. DUAL TECHNOLOGY WALL SWITCH WITH DIMMING AND DAY-LIGHT CONTROL: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Dual technology sensors shall have one of its two technologies, not require motion to detect occupancy.

2. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period.

3. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 15 minutes.

4. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated.

5. Sensor shall be capable of switching both 120 VAC and 277 VAC.

6. Sensor shall recess into single gang switch box and fit standard GFI opening.

7. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.

8. Line and load wire connections shall be interchangeable.

9. Wall switch sensor shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point.

10. Sensor shall be capable of both auto-on and manual operation.

11. Combination photocell/dimming sensors set point and deadband shall be automatically calibrated through the sensors microprocessor by initiating the automatic set point programming procedure. Min and max dim settings as well as set point may be manually entered.

12. Subject to compliance with the above requirements, provide models of one of the following:

    a. Sensor-Switch – WSX-PDT-D Series

    b. Green Gate – CSW-d-010

© BNA Consulting

C. DUAL TECHNOLOGY CEILING SENSOR: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate ultrasonic (microphonics) and infrared technologies in a single unit.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use internal microprocessor for motion signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm that adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if sensor is left in test mode.
7. Sensor's microprocessor shall automatically extend timer by 1 hour in response to recognition to false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
8. Sensor's microprocessor shall automatically reduce either PIR or ultrasonic sensitivity in response to false on condition.
9. Sensor microprocessor will automatically monitor PIR background threshold signal level and makes corresponding sensitivity adjustments automatically.
10. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
11. For airflow that is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
12. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar.
13. An internal 24 hour 7 day clock establishes what periods the room is typically occupied, biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
14. Sensor shall have selection settings for the following dual technology schemes:
    a. High Sensitivity and High Confidence (miser mode)
15. Sensor shall be available with either 180 degrees or 360 degrees coverage pattern.
16. Infrared lens shall have 360 degree field of view. Two types of lens shall be available, standard and extra dense.
17. Sensor shall have a variety of mask inserts for PIR coverage rejection to prevent false tripping.
18. Transducers shall be protected from tampering.
19. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
20. Sensor shall have adjustable sensitivity from 0% to 100% for both ultrasonic and infrared.
21. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
22. Sensor shall be available with a photocell adjustment from 20 to 3,000 Lux.
23. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.

© BNA Consulting

24. Sensor shall have two (if 180 degree) or three (if 360 degree) real time LED motion indicators visible from the front of the unit: Red = infrared; green = ultrasonic.

25. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-ATD Series

    b. Sensor Switch-CM-PDT 9/10 Series

    c. Wattstopper-DT Series

    d. Mytech-Omni-DT Series

    e. Leviton – OSC UOW Series

    f. Greengate OAC– DT Series

    g. Douglas – WOR Series

D. 24 VDC POWER/CONTROL PACK: Where units are indicated, provide a power/control pack that meets the following minimum requirements:

1. Control module shall consist of a DC power supply and a dry contact relay for switching a lighting load.

2. Control module shall be available in versions to accept 120, and 277 VAC line voltages.

3. Output shall be 24VDC nominal, and shall be inherently safe, low voltage, limited power output (Class 2).

4. Output shall supply 100mA current, in addition to current consumed internally to operate internal relay.

5. Relay shall utilize normally open, silver alloy dry contacts, and shall be rated for a 20A ballast load at 120V and 277V.

6. Relay function shall not require more than 5 mA control current to operate.

7. Control module shall have line voltage wiring, consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power, and control wires, exiting from the other end.

8. Control module shall be sized to fit inside a standard 4” x 4” junction box.

9. Control module shall be equipped with a 1/2” EMT threaded male fitting on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.

10. Control module shall be equipable with accessory 1/2” EMT threaded male fitting on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.

11. Slave module shall be available for switching additional circuits. Slave module has same construction and specifications as control module except without power supply function.

12. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-CU Series

    b. Sensor Switch-MP20 Series

    c. Wattstopper-BEP Series

    d. Mytech-MP Series

    e. Greengate SP20-MV Series

    f. Leviton – OSC/OSA Series

    g. Douglas – WP-PP

© BNA Consulting

PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

A. Install occupancy lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

B. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.

D. Contractor shall be on site as required, to adjust lighting control units for proper operation.

E. Mount the switchpack in a standard 4" junction box. Mount sensor to a standard 4" junction boxes. Refer to manufacturer supplied mounting instructions.

F. Spare Parts: Refer to Section 26 0502 for requirements.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.

B. System start-up: Provide a factory authorized technician to verify the installation and test the system.

C. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

D. Contractor shall visit the job site 3 months after the owner has taken occupancy and adjust any units not operating properly, otherwise remove and replace with new units.

3.3 PRODUCT SUPPORT AND SERVICES:

A. System Start-Up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:

1. The sensors have been fully installed in accordance with manufacturer's installation instructions.
2. Low voltage wiring for overrides and sensors is completed.
3. Accurate 'as-built' load schedules have been prepared.
4. Proper notification of the impending start-up has been provided to the owner's representative.
5. Programming of all switches, sensors, power packs, relays, etc. shall be completed by factory authorized technician, prior to final and training.

B. Factory support: Factory telephone support shall be available at no cost to the owner during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll free number for technical support.

C. Functional Testing:

1. The owner shall hire a third party that will conduct and certify the functional testing.

2. Lighting controls devices shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working conditions

© BNA Consulting

in accordance with the construction documents, manufacturer's instructions and code requirements. The following shall be performed:

a. Certify that sensors have been located, aimed and calibrated per manufacturer recommendations.

b. Status indicator operates properly.

c. Fixtures that are controlled by auto-on controls turn on to permitted level.

d. Fixtures that are controlled by manual on controls operate when manually activated.

e. Fixtures do not turn on incorrectly due to HVAC or movement outside the controlled area.

f. Confirm that occupancy sensors turn off after space is vacated and do not turn on unless space is occupied.

g. Simulate unoccupied conditions and confirm that vacancy sensors only turn on manually and turn off after space is vacated.

3. The party responsible for the functional testing shall provide documentation that the installed lighting controls meet or exceed all performance criteria and shall not be directly involved in the design or construction of the project.

3.4 WARRANTY:

A. Manufacturer shall provide a one (1) year limited warranty on lighting control system. A ten (10) year limited warranty shall be provided on the lighting control relays.

3.5 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

3.6 TRAINING

A. Provide four (4) hours of video taped training in two 2 hour sessions on the operation and use of the lighting control equipment, at job site, at no cost to the Owner.

3.7 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 26 0923

© BNA Consulting

SECTION 26 2726

WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles
2. Switches
3. Cord caps
4. Cord connectors

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices that have been UL listed and labeled.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 FABRICATED WIRING DEVICES:

A. GENERAL:

1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.

B. Provide wiring devices (of proper voltage rating) as follows:

	RECEPTACLE	SWITCHES			
MFGR		1-POLE	3-WAY	4-WAY	W-PILOT
Hubbell	HBL 5352	HBL 1221	HBL 1223	HBL 1224	HBL 1221-PL
Bryant	5352	1221	1223	1224	1221-PL
Pass Seymour	5352	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	5362	1221	1223	1224	
Cooper	5352	1221	1273	1224	1221-PL

C. Provide devices in colors selected by Architect. Provide red devices on all emergency circuits.

D. TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) RECEPTACLES:

© BNA Consulting

1. Provide TVSS receptacles having 4 series parallel 130V MOV's capable of a minimum of 140 joules suppression. Provide units with visual (and audible) surge status indicators to monitor condition of surge circuit; visual indicator to be "on" when power present and suppression circuit is fully functional. (Audible indicator shall sound a "beep" alarm approximately every 30 seconds if suppression circuit has been damaged.) Provide NEMA 5-20R, 20 amp, 125V receptacle of one of the following manufacturers:

	MANUFACTURER	
SPECIFICATION GRADE	**HUBBELL**	**PASS SEYMOUR**
Duplex Recept-Visual only	5350	5352 XXXSP
Duplex Recept-Visual/Audible	5352	5362 XXXSP
Single Recept-Visual only	5351	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG5352S	IG5362 XXXSP
Single Recept-Isol Gnd, Visual only	IG5351S	N/A
HOSPITAL GRADE	**HUBBELL**	**PASS SEYMOUR**
Duplex Recept-Visual/Audible	8300HS	8300 XXXSP
Single Recept-Visual only	8310HS	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG8300HS	IG8300 XXXSP
Single Recept-Isol Gnd, Visual only	IG8310HS	N/A

2. Color of devices selected by Architect. Provide red devices on all emergency circuits.

E. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide Hospital grade where required elsewhere by specification or drawings. Provide units of one of the following:

   a. P&S/Sierra

   b. Hubbell

   c. Leviton

   d. Square D

F. CORD CAPS AND CONNECTORS:

1. Provide 3, 4 and 5-wire grounding, cap plugs, and connectors of ampere and voltage rating required, for final equipment, and as indicated otherwise on drawings.

2. Provide products of one of the following:

   a. Cooper

   b. General Electric

   c. Hubbell

   d. Leviton

© BNA Consulting

e. P&S

2.2 WIRING DEVICE ACCESSORIES:

A. WALL PLATES:

1. Provide coverplates for wiring devices; plate color to match attached wiring devices. Provide stainless steel coverplates in all finished areas. Provide galvanized steel plates in unfinished areas. Provide blank coverplates for all empty outlet boxes.

PART 3 – EXECUTION

3.1 GENERAL

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings before beginning rough-in of electrical work. Adjust locations of all electrical outlets as required to accommodate work in area, and to avoid conflicts with wainscoat, back splash, tackboards, and other items.

C. Install wiring devices only in electrical boxes that are clean; free from excess building materials, dirt, and debris.

D. Install blank plates on all boxes without devices.

E. Delay installation of wiring devices until wiring work and painting is completed. Provide separate neutral conductor from panel to each GFI receptacle.

F. Install GFI receptacles for all receptacles installed in the following locations:

1. Restrooms, locker rooms, kitchens, within 6 feet of any sink, or when serving vending machines and electric drinking fountains.

2. Indoor wet locations, non-dwelling garages, elevator rooms and pits.

3. Outdoors, and on rooftops.

G. Where light switches or wall box dimmers are specified, provide a separate neutral for each phase of the branch circuits that switches or dimmers are connected.

H. Electrical Identification: Refer to Section 260553 for requirements.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

A. At time of substantial completion, replace those items, that have been damaged, including those stained, burned and scored.

3.3 GROUNDING:

A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with

© BNA Consulting

requirements.

END OF SECTION 26 2726

© BNA Consulting

SECTION 26 2815

OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of overcurrent protective device work is indicated by drawings and schedules and specified herein. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 262413, Switchgear and Switchboards, and Section 262416, Panelboards.

B. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:

1. Molded case thermal circuit breakers
2. Fusible switches
3. Fuses

C. Refer to other Division-26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE

A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard manufacturer):

B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:

1. Cutler Hammer Products, Eaton Corp.
2. GE/ABB
3. Square D Co.
4. Siemens Energy and Automation

C. MOLDED CASE THERMAL TRIP CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole.

© BNA Consulting

Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.

2. Circuit breakers 15 amps through 599 amps shall be molded case thermal trip circuit breakers.

D. FUSIBLE SWITCHES:

1. Provide factory-assembled fusible switch units for power distribution panelboards and switchboards, and individual mounting as indicated. Provide switch units of amperage, voltage, and RMS interrupting rating as shown, with quick-make, quick-break mechanisms, visible blades and dual horsepower ratings. Series rated systems are not acceptable. Equip with lockable handles with on-off indication. Interlock switch covers and handles to prevent opening in "ON" position. Provide switch with Class R rejection fuse clip kits. Provide AL/CU rated lugs of proper size to accommodate conductors specified.

2.2 FUSES

A. GENERAL: Except as otherwise indicated, provided fuses of type, sizes and ratings and electrical characteristics of a single manufacturer as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Provide Buss KAZ signal activating fuses where required elsewhere in specification.

B. Where fuses are shown feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing; adjust fuse size and type as necessary to comply with manufacturer's recommendation.

C. Provide and install spare fuse cabinet in main electrical room.

D. BRANCH CIRCUITS: For motor circuits, transformer circuits, or other inductive loads, provide UL Class RK5 (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECN-S or FLN-R, FLS-A). For other circuits, provide UL Class RK1, (KTN-R, KTS-R OR A2K-R, A6K-R or NCLR, SCLR OR KLNR, KLSR).

E. MANUFACTURER: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussman Mfg. Co.

2. Mersen (Ferraz Shawmut)

3. Reliance Fuse Div./Brush Fuse Inc.

4. Littlefuse, Inc.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.

C. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance

tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.

D. After the switchgear is energized and just prior to Substantial Completion, the contractor shall ensure that the field-adjustable circuit breakers and solid-state circuit breakers and associated trip mechanisms have been set to the appropriate settings as recommended by the equipment Manufacturer (or as recommended by the electrical contractor's Protective Device Study if section 260573 has been included in the project). Time-current trip curves and trip setting information as was required in the Submittal portion of this specification shall be made available by the contractor at this time.

E. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

F. Electrical Identification: Refer to Section 260553 for requirements.

3.2 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 26 2815

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 4119

DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.

B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.

C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.

D. Refer to sections of other Divisions for applicable requirements affecting demolition work.

E. Refer to Section 260500 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE:

1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

3.2 PATCHING AND REPAIR

A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.

B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, roofing, etc.

C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

3.3 EXISTING EQUIPMENT

A. The following is a part of this project and all costs pertaining thereto shall be included in

© BNA Consulting

the base bid.

B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.

C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.

D. The new fixtures indicated for existing outlets shall be installed in accordance with the fixture specifications.

E. When installing equipment in the existing building, it shall be concealed.

F. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.

G. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.

H. Existing raceways may be used where possible in place, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated. Re-used raceway shall meet all requirements for new installations.

I. The existing light fixtures that are not used in the remodeled area shall be carefully removed, and disposed of. Those fixtures indicated for re-use shall be thoroughly cleaned, repaired as required, relamped and installed as indicated.

J. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.

K. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 26 4119

© BNA Consulting

SECTION 26 5100

INTERIOR AND EXTERIOR BUILDING LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Types of lighting fixtures in this section are indicated by schedule and include the following:

1. LED (Light Emitting Diode)

1.3 QUALITY ASSURANCE:

A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Provide lighting fixtures that have been UL-listed and labeled.

B. Components and fixtures shall be listed and approved for the intended use by a National Recognized Testing Laboratory (NRTL) including: UL, ETL, and CSA or equivalent

C. All led products shall comply with the latest version of Illuminating Engineer Society (IES) publications LM-79 and LM-80.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of fixture):

1. LED:

a. Cree

b. Nichia

c. Samsung

d. Philips Lumiled

e. Osram

f. Xicato

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, LED drivers, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with damp or wet location label as required by application.

© BNA Consulting

B. SUPPORT REQUIREMENTS:

1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.

C. LIGHT EMITTING DIODE (LED) LUMINAIRES:

1. LED luminaires that can be serviced in place shall have a disconnecting means internal to the luminaries to disconnect simultaneously from the source of supply all conductors of the driver, including the grounded conductor. Disconnects shall not be required under the following exceptions:

a. Luminaries located in hazardous locations.

b. Luminaries used for egress lighting.

c. Cord-and-plug luminaries.

d. In industrial establishments with restricted public access where conditions of maintenance and supervision ensure that only qualified persons service the installation.

e. Where more than one luminaire is installed in a space and where disconnecting the supply conductors to the luminaire will not leave the space in total darkness.

f. Provide LED luminaires which are tested in accordance with IES LM-79, diodes tested in accordance with IES LM-80, and provide a minimum R9 rating of ≥ 50 (unless specified differently), a CRI rating of ≥ than 80 and L70 (6K) = 50,000 hours (IES TM-21). Provide with 0-10V dimming drivers as standard.

g. The fixture manufacturer(s) shall warrant the luminaires, in their entirety, to be free from defects in material or workmanship for at least 5 years from date of manufacture. Provide warranty in accordance with other sections of this specification and include a certificate of warranty from the fixture manufacturer with extended warranty information and proper forms and procedure description.

D. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other work as appropriate to properly interface installation of lighting fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.

C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the building structure; independent of the ceiling system, unless noted. Support each recessed fixture (fluorescent incandescent, and/or HID) from the building structure with #12 ga. steel wire attached to each corner (in addition to supports normally provided for attachment to the ceiling system). Provide

© BNA Consulting

backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support surface mounted ceiling fixtures from channel. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. Feed each recessed fixture directly from an outlet box with flex conduit as required; do not loop from fixture to fixture. See plans for additional details.

D. FIXTURE WHIPS:

1. Provide each lay-in light fixture with at least 36" (Not to exceed 72") of 3/8" steel flexible conduit.

2. With-in spaces utilizing 0-10v control schemes ie: Room Controllers, the fixture whip shall be comprised of a MC-PCS Cable (see Section 26 0532 Conduit raceways) with at least 36” and not to exceed 72” in length located above removable grid ceilings.

E. Coordinate lighting in mechanical room with duct and equipment locations to avoid obstruction of illumination.

F. Provide gypsum board protection as required, (acceptable to fire official having jurisdiction) to ensure fire rating of each ceiling that the fixtures are installed in.

G. COORDINATION MEETINGS:

1. Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area.

2. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all fixtures and duct work in all areas.

H. ADJUST AND CLEAN:

1. Clean lighting fixtures of dirt and debris upon completion of installation.

2. Protect installed fixtures from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish.

I. SPARE PARTS: Refer to Section 26 0502 for requirements.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.

C. At the time of Substantial Completion, replace lamps in interior lighting fixtures that are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer.

D. GROUNDING:

1. Provide equipment grounding connections for each lighting fixture.

END OF SECTION 26 5100

© BNA Consulting

BLANK PAGE

© BNA Consulting

SECTION 26 5561

STAGE LIGHTING & DIMMING SYSTEM

PART 1 – GENERAL

1.1 INTENT:

A. The intent of this specification is to define parameters for furnishing and installing a complete working system to the owner. The system is designed to meet specific operational requirements of Ben Lomond High School. Performance deviations will not be accepted.

1.2 SCOPE

A. THE SCOPE OF THIS WORK INVOLVES THE FOLLOWING:

1. Provide and install (1) 96 circuit dimmer rack for the Auditorium.
2. Reuse existing 300 amp 120/208V AC power feeders for the dimmer rack.
3. Provide and install an architectural lighting control processor for control of house lighting.
4. Provide and install lighting control console and console outlets as indicated.
5. Provide and install control panels, control receptacles, etc., as indicated.
6. Provide and install new wiring devices as indicated.
7. Provide and install all required control wiring. All components necessary to make the system a working network shall be included in the bid. Actual length of network cabling and system layout shall be verified during the project approval process.
8. Provide theatrical fixtures and accessories as indicated

1.3 Drawings:

A. Drawings shall be furnished as follows:

1. One PDF set of drawings shall be furnished for approval within 30 days of award of contract. Prior to fabrication of equipment, one set shall be returned appropriately marked as the approval document.
2. The installing contractor shall be furnished with up to four sets of B size drawings for his/her use.
3. The owner shall be supplied with two sets of "as-built" drawings at the completion of the installation. These drawings shall be part of an operations and maintenance manual covering all major items installed.

1.4 Quality Assurance

A. To ensure a uniform installation and single responsibility, the lighting control system shall

© BNA Consulting

be provided and warrantied by a single manufacturer. This manufacturer shall have manufactured electronic lighting controls for a minimum of 10 years. Companies who assemble dimming racks or banks from components supplied by others, even if that component is private labeled, are excluded from this bid. Mixing of equipment brands shall not be acceptable.

B. The manufacturer shall have a factory authorized service provider with at least one full time manufacturer certified service technician on staff located within 50 miles of the job site. In addition, the manufacturer shall provide a 24-hour service hotline.

1.5 Standards

A. All equipment, where applicable standards have been established, shall be built to the standards of Underwriters Laboratories, Inc., the National Electric Code, and the United States Institute for Theater Technology. Approved equipment shall be so labeled on delivery to the job site.

1.6 Substitutions

A. The equipment specified is the result of efforts on the part of the owner to select equipment for reliability, ease of maintenance and suitability for the owners' purposes. The base bid shall be for Electronic Theatre Controls, Inc. Equipment manufactured by Strand Lighting, Inc will also be accepted provided it meets the requirements of the specification:

B. Proposals for equipment from other manufacturers, including those listed above, will be considered provided the equipment is fully digital in operation and sufficient documentation is submitted ten days prior to bid date to establish that it meets these specifications. The price for alternate equipment must be identified as an alternate bid and the amount stated as an addition or deduction to the base bid.

C. Submittals shall include but not be limited to: complete Bill of Materials; one line control riser that identifies, by product name, all dimming and control equipment as well as wire types and counts; cutsheets on all proposed equipment showing full technical specifications, and a document identifying all deviations from this specification.

D. Any revision or addition to the wiring required by substitute equipment shall be the responsibility of the substituting contractor. This contractor shall also be responsible for any additional architectural or engineering fees occasioned by the necessity of evaluating alternate proposals.

E. No exception shall be made to the requirement for optical isolation.

F. No deviation shall be permitted from the requirement for UL listing.

1.7 Fabrication

A. Fabrication shall begin only after approved drawings and a written notice to proceed have been delivered to the manufacturer at the manufacturer's place of business.

© BNA Consulting

1.8 Energization

A. A qualified engineering representative certified by the manufacturer for system startups shall visit the job site after installation is complete and prior to the energization of the system to inspect, test and adjust the system. She/he shall also at that time instruct the owners' representatives in the operation and maintenance of the system. These services shall not exceed two days and shall be provided within 21 days written notice by the contractor.

1.9 Warranty

A. Electronic Theatre Controls, Inc. (ETC) warrants to the original owner that for a period of two years from date of energization of a permanently installed system, its products will be free from defects in materials and workmanship under normal use and service.

1.10 Manufacturer Services

A. Service shall be provided directly by the manufacturer and service calls shall be made within 24 hours.

PART 2 - DIMMER SYSTEM

2.1 POWER CONTROL ENCLOSURES

A. Product: Sensor3 Installation Enclosures (SR3) by ETC Inc. Power control system with high-density, professional features and exceptional reliability for lighting applications requiring power control.

1. SR3-48 Enclosure: 48 modules, 96 circuits maximum.

B. Mechanical:

1. Construction: 16 ga steel.
2. Finish: Fine-textured, scratch-resistant epoxy paint.
3. Top and Bottom Conduit: Access through removable panels (SR3-48) or knockouts (SR3-6, SR3-12, and SR3-24).
4. Keyed module slots prevent insertion of incompatible module types.
5. Front access to all wiring and terminations.
6. Full height locking door.
7. Electrostatic air filter easily removed from door for periodic cleaning.
8. High-efficiency cooling system with reporting.
9. High-visibility LED status beacon.

C. Electrical:

1. SR3 Enclosures Accept the Following Feeds:
2. Power: Three-phase 120 / 208 VAC.
3. Line Feed Frequencies: 47 to 63 Hz.

4. Line Feed Voltage Range: 91 to 139 VAC. Max main transformer tap recommended is 135 V to allow for line fluctuation.

5. Short Circuit Current Rating: 100,000 Amps RMS symmetrical.

D. Thermals:

1. 32 to 104 degrees F. Electrical Room HVAC Systems: Must maintain the specified ambient temperature at all times.

2. Relative Humidity: 10 to 90 percent non-condensing.

E. Control: CEM3 Power Control Processor.

1. Construction:

a. Body: Formed steel.

b. Face Panel: Diecast.

c. Finish: textured epoxy paint.

2. Slide-In Module: Toolless installation and removal. Spring-loaded release.

3. Airflow Sensor: Ensures adequate airflow.

4. Two configurable DMX512 inputs (rear, 2500 V opto-isolated).

5. Two Ethernet ports:

a. Front: for direct service connection.

b. Rear: for operation on lighting control network.

6. Graphical LCD: Eight line by 20 character for system configuration, live control, and status display.

7. Number Pad: For quick access to dimmers.

8. Shortcut Buttons: For Setup, about, and live control.

9. Five Status LED Indicators: Power, Network activity, DMX-A DMX-B, and Panic.

10. User-Programmable Presets: 64.

11. UL 924 Listed Panic circuit with flexible configuration.

12. Configuration Backups: Saved on USB or network.

13. Dimmer Outputs: Regulate to maintain constant power plus or minus 1 Volt.

14. Individual output scale voltage settings for load wiring compensation.

15. Selectable Firing Modes: Normal, Forward Phase, Reverse Phase, Dimmer Doubled, Sinewave, and Fluorescent.

16. Control Modes: Dimmed, Switched, Latch/lock, Always On, and Off.

17. Selectable Dimmer Output Curves: Linear, Modified Linear, Square, Modified Square, Sensor 2.0, and five custom curves.

18. 16 bit fade resolution. Greater than 30,000 Step Resolution per 1/2 cycle.

19. Selectable data loss behavior.

20. Feedback:

a. Sensor racks with CEM3 modules include basic system diagnostic reporting.

© BNA Consulting

b. Standard Rack Feedback Includes: DMX input status, rack power status, and rack temperature.

c. Advanced Features (AF): Provides dimmer-specific status and load feedback. Requires AF dimmer rack and AF dimmer modules.

21. Mobile Application: ThruPower System Reporter (TPSR).

a. Mobile application shall select the circuit to configure either by scanning a QR code label applied to circuit distribution or by manual entry of circuit information.

b. Mobile application shall allow users to set the Control Mode of the selected circuit in order to shift a ThruPower module between Dimmable and Switched mode according to the requirement of a connected load.

c. Mobile application shall allow users to activate the circuit test function for the selected module.

d. Power controls which do not support mobile circuit configuration from the plugin location of a supported load shall not be acceptable.

22. Power Control Modules:

a. Rated for continuous duty at 100 percent of rated load.

b. Circuits: 1.2 kW, 1.8 kW, 2.4 kW, and 6 kW.

c. Physical: Dual-density (two circuits per module), modular plug-in assemblies. Keyed to prevent improper insertion.

d. Cast aluminum chassis, finished with textured epoxy paint.

e. Circuit Breakers: Fully magnetic to eliminate nuisance tripping.

i. Inrush Current Rating: 20x.

ii. Must Trip Rating: 125 percent, 10 to 100 seconds.

iii. Rated for 100 percent switching duty applications.

23. Power Device: Sealed, patented assembly. Field-replaceable with screwdriver.

a. Two back-to-back SCRs per circuit (Dimmer and ThruPower modules).

b. Per-circuit LED indicators.

c. Mechanical held air gap relay.

d. Integral bonded heatsink.

e. Integral temperature sensor.

24. Filtering: High quality toroidal filters.

25. Sensor3 Module Series:

a. Dimmer Series: Forward-phase dimming of tungsten, incandescent, magnetic, or cold cathode loads.

b. Relay Series: Air-gap relays for switched power control.

26. Standards Compliance: Listed: cULus.

27. Quantities and configurations of Sensor3 enclosures, modules, and accessories to be supplied as shown on project drawings.

© BNA Consulting

2.2 CIRCUIT AND DATA DISTRIBUTION

A. Product: Circuit and data distribution as supplied by ETC Inc.

1. Floor pockets
2. Electronic control plug-in boxes (ECPB).
3. Mechanical:
    a. Construction: Boxes constructed from 18 ga and 14 ga steel. NEMA and ECPB faceplates constructed of aluminum.
    b. Finish: Fine-textured black powder coat.
    c. Include mounting brackets and hardware.
4. Electrical:
    a. Wire Entry: Conduit knockouts to feed-through terminals individually labeled with corresponding circuit numbers.
    b. Wire Exit: Connectorized receptacles, conduit knockouts, or cable glands.
    c. Low voltage barriers or junction boxes as required.
5. Finish: Fine-textured black powder coat paint.
6. Circuit Labels: 2 in. (50 mm); vinyl; white lettering on black; front only.
7. Standards Compliance: cULus Listed to UL 1573 and CSA C22.2 No. 166.
8. Power and data distribution equipment to be supplied as shown on project drawings.

2.3 ARCHITECTURAL CONTROLS

A. TOUCHSCREENS:

1. Product: Unison Paradigm 18 inch Touchscreen Control Station by ETC, Inc. High-resolution interface, Configurable graphic interface with controls and information displays required for managing lighting systems.
    a. Model P-TS-18: Paradigm 18 inch Table Top Touchscreen.
2. Product: Unison Paradigm Portable Touchscreen by ETC, Inc.
    a. Model P-TS7-PE: 7 in Portable Touchscreen (NetConnect/Ethernet).
3. Standards Compliance: UL and cUL LISTED. CE Compliant.
4. Functional:
    a. Built-in setup interface, separate from user configured pages.
    b. Configuration Upload from the Following Sources:
        i. LightDesigner software.
        ii. USB Flash Drive, via built in USB port.
        iii. SD media.
    c. Ability to store multiple configurations and to select which configuration is active from an on-screen menu.

d. Allows at least 30 separate control pages.

e. Control Functions:

i. Individual zone control.

ii. Preset record and selection.

iii. Room Combine Controls.

iv. Preset, color, sequence, macro, and custom function activation.

v. Change, initiate, or override timed events.

vi. Multi-level electronic lockout.

f. Custom controls configured from LightDesigner software.

g. Custom graphics configured from ControlDesigner software.

h. Supports Windows 7 and newer HID compliant Touchscreen Displays.

i. Software controlled lock-out and control visibility using up to 5 unique passcodes.

5. Mechanical - 18 inch Touchscreen Control Station:

a. Adjustable brightness and contrast for low light conditions.

b. Backlit, color 18.5 inch LCD display with capacitive touchscreen interface.

i. Resolution: 1366x768 WXGA TFT resolution.

ii. Pixel Pitch: 300 vertical and horizontal.

iii. Luminance: 250 candles per sq m.

iv. Response Time: 5 ms.

v. Viewing Angle: 170 degrees vertical, 160 degrees horizontal.

c. 100mm x 100mm VESA mountable.

d. Fanless operation.

e. Mounting: Rack-mount.

6. Mechanical - Portable Touchscreen:

a. LED-backlit, color LCD display with touchscreen interface.

b. Aluminum enclosure in black anodized finish.

c. Adjustable brightness and contrast for low light conditions.

d. 7 inch WVGA display (800x480) with 24-bit color.

e. LCD touchscreen covered by lid when in closed position.

f. 10 ft removable cable (NetConnect model only).

7. Electrical - 18 inch Touchscreen Control Station:

a. 120-240 VAC power Input to included 12 VDC power supply.

b. Built in over current and surge protection.

c. RJ-45 Socket for wiring over CAT 5/ 5e/ 6 standard Ethernet cable to the control system

© BNA Consulting

d. USB connectors for configuration and software upload.

8. Electrical - Portable Touchscreen:

a. Connection to Unison Paradigm control system using Unison Heritage portable plug-in stations (UH1RS) or Ethernet Stations (UH-NET).

b. Linkconnect Network uses Topology free and polarity independent Class 2 control network over Belden 8471 plus two No. 16 for 24 VDC AuxPower and one No. 14 ESD drain wire.

i. Wiring may be buss, loop, home-run, or any combination of these.

c. NetConnect wiring uses standard Ethernet Infrastructure over twisted pair ethernet.

i. Star topology using standard PoE Ethernet Switches.

ii. PoE Class 2 Device (6 W).

9. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).

10. Relevant Humidity Non-Condensing: 0 to 90 percent.

B. UNISON CONTROL SERIES:

1. Product: Paradigm Architectural Control Processor by ETC, Inc.

a. Model P-ACP: Unison Paradigm Architectural Control Processor.

2. Standards Compliance: cULus Listed. CE Compliant.

3. Functional:

a. Capacity:

i. Channels of Control: 1,024.

ii. Stations: 128.

b. System:

i. Net3 system interoperability including sACN.

ii. Network Time Protocol for real-time clock synchronization supporting real and astronomical events.

iii. Two physical DMX ports, each configurable as an input or output.

iv. Configuration of DRd dimming operations.

v. 12 control processors per system.

1. Addition of processors to a system proportionately increases the overall capacities.

c. Serial Input/Output:

i. Eight-bit word length, parity selection and one or two stop bits.

ii. Fully customizable input and output messages.

iii. Bi-directional.

© BNA Consulting

d. Configuration Data:

i. Remote upload from a connected PC running LightDesigner or another connected Paradigm ACP.

ii. Stored in removable solid-state memory for easy transfer to another Paradigm ACP.

e. Local User Interface:

i. Control functionality for control channels, zones, fixtures, groups, presets, macros, walls, and sequences.

ii. Ability to schedule timed events (add/edit/delete).

iii. Transfer of configuration using removable media.

iv. Transfer of configuration to and from touchscreen stations using removable media.

f. User Access Controls: Two user accounts: Administrator and User. Local to each processor.

g. Web User Interface:

i. Internal web server accessible via Ethernet port.

ii. Activate and deactivate presets.

iii. Schedule timed events (add/edit/delete).

iv. Displays status information and log files.

v. Configuration of processor settings.

vi. Supports configurable user login security options.

h. Diagnostics: Standard and Critical Event logging.

i. Stations:

i. Connected to a Paradigm processor via topology-free LinkConnect, or star-topology NetConnect.

ii. Discovery and binding accomplished from the local user interface or LightDesigner.

j. Operation:

i. Configurable DMX output refresh rate.

ii. Support for 16-bit DMX attributes.

iii. User configurable arbitration for multiple internal and external source data.

4. Mechanical:

a. For use in Unison DRd Rack Enclosure Series and Unison ERn Control Enclosure Series.

b. Microprocessor-based, solid-state technology provides multi-scene lighting and building controls.

c. Fully-contained plug-in module with no discrete wire connections.

d. Tool-free installation.

e. Front-panel user interface with backlit LCD and alphanumeric button panel.

© BNA Consulting

f. RJ-45 Ethernet, Secure Digital (SD) and Universal Serial Bus (USB) media on front panel.

5. Electrical:

a. No discrete wiring connections required for use in a dimming or control enclosure.

b. Echelon LinkPower communications with remote devices, including button stations, button/fader stations, touchscreen stations, sensors, and third party LonMARK compliant products.

c. Hot swappable.

d. System configuration and programming stored in flash memory.

e. Support of ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols.

f. EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.

g. Two discrete ESTA DMX512A ports, configurable as input or output ports.

h. User Datagram Protocol (UDP) messaging input and output for control of Paradigm or external systems.

i. Four dry-contact closure inputs.

j. Four contact-closure outputs rated 1 A at 30 VDC.

6. Operating Temperature Range: 32-104 degrees F (0-40 degrees C).

7. Relevant Humidity Non-Condensing: 10 to 90 percent.

C. Product: Unison ERn External Control Enclosure by ETC, Inc.

1. Model ERn2-RM-__ Single Processor Control Enclosure-Rack Mount.

2. Standards Compliance: cULus Listed, CE Compliant.

3. General:

a. External Processing Enclosure designed for one or two control processors plus options and accessories.

b. Full 2-year Warranty.

4. Mechanical:

a. 18-gauge formed steel construction.

b. Fine-texture, scratch-resistant epoxy paint.

c. Wall-mount and 19 in rack-mount variants.

d. Rack-mount enclosure sizes: ERn2: 5U and ERn4: 8U.

e. Rack mount offers connectorized rear panel for all wiring connections.

f. Convection-cooled.

g. Hinged, Locking door with limited access to control processor. Integral electrostatic air filter.

h. Tool-free module removal and installation.

© BNA Consulting

i. 19 in equipment-rack mount offers connectorized rear panel for all wiring connections.

j. Wall-mount offers front access wiring terminations.

k. Top, bottom, and side knockouts for conduit entry.

5. Electrical:

a. External control enclosure rated for 100 V, 120 V, 230 V CE or 240 V UL single phase configurations, 3.5 A maximum draw at 120 V.

i. AC (single phase).

ii. 24 VDC (2-16 AWG).

iii. LinkConnect.

iv. Two configurable DMX512A ports.

v. RS232 Bi-directional serial.

vi. Cat5/5e UTP Ethernet.

vii. Contact I/O, 4in/4out (14 to 26 AWG).

1. Contact output rated 1 A at 30 VDC.

b. Contractor-supplied input and control wiring.

c. Factory-provided connectors for wiring terminations.

6. Operating Temperature Range: 32 to 104 degrees F (0 to 50 degrees C).

7. Relevant Humidity Non-Condensing: 10 to 90 percent.

D. UNISON HERITAGE CONTROL SERIES:

1. Model UH10001: 1-gang, 1-button.

2. Standards Compliance: cULus Listed. CE Compliant.

3. Mounting: Flush, Surface.

4. Functional:

a. Button and keyswitch functions: preset selection, record mode activation, station lockout, raise, lower, macro activation, zone on/off control, timed-event override, and wall open/close or toggle.

b. Custom button functionality programmable via LightDesigner configuration software.

c. Programmable electronic lockout levels.

d. Allows for programming of individual lockout levels.

5. Mechanical:

a. Gangable for custom applications.

b. Enclosed electronics assembly and faceplate included.

c. Cantilevered switch arrays with removable caps.

d. No visible means of attachment.

e. Flush-mount in industry standard back box, RACO 690 or equivalent.

f. Surface-mount backboxes available from manufacturer.

© BNA Consulting

g. Constructed of injection-molded, ABS plastic.

h. Indelibly marked legends in a contrasting color.

i. Integral RGB LED response indicator for each button.

j. Integrated IR receiver.

k. Unison Heritage Locking Cover.

6. Electrical:

a. Connect via Echelon LinkPower control network utilizing low-voltage Class II wiring.

b. Topology-free and polarity-independent wiring over Belden 8471 and one No. 14 ESD drain wire.

i. Wiring may be bus, loop, home-run, or any combination of these.

c. All station terminations are connectorized.

7. Operating temperature Range: 32 to 104 degrees F(0 to 40 degrees C).

8. Relative Humidity, Non-Condensing: 30 to 90 percent.

2.4 GENERAL NETWORK

A. GENERAL

1. The controls network shall provide data distribution over TCP/IP Ethernet networks. Data shall be layer 3 routable. Systems using proprietary formats or formats other than 10/100/100Mbit wired Ethernet or non-layer 3 routable networks shall not be accepted.

2. Connections shall be made between consoles, face panels, architectural processors, dimmers, gateways, and computers over standard Ethernet distribution systems using 100BaseT, 100BaseFL, or greater wiring. All installations shall conform to established Ethernet wiring practice, and installation shall be performed by contractors qualified to do this type of work. All wiring shall be tested at Category 5e or higher for full bandwidth operation to the appropriate IEEE standard.

3. The Lighting Control system must be supplied by a single manufacturer and must have seamless integration over Ethernet between the Entertainment and Architectural lighting control.

B. CAPACITIES

1. The network shall support DMX routing, patching, and prioritization for up to 63,399 universes (32,767,488 DMX addresses). Each address may be input or output from any port on any DMX gateway in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of gateways supported by the Ethernet topology.

2. The network shall support multiple network hosts including consoles, gateways, dimming racks, computers, file servers, printers, and architectural control processors with discrete command lines and control. The lighting network shall

© BNA Consulting

support multiple venues within a system and discrete systems on the same network.

3. System Configuration and Monitoring

   a. Network device configuration shall be via Net3 Gateway Configuration Editor (GCE) software and/or ANSI E1.17 Architecture for Control Networks (ACN).

   b. Patch addresses shall support viewing and manipulation via ANSI E1.17 ACN.

      i. The system shall permit complete user flexibility allowing the system operator to patch each DMX input address to any ANSI E1.31 streaming ACN address, and DMX output to span streaming ACN universes.

      ii. The lighting system shall support assignment of DMX offsets, truncation of DMX universes, and provide choice of DMX port prioritization.

      iii. The lighting system shall support the DD start code extension to ANSI E1.31 which provides priority per address such that multiple control sources can share universes with discrete control per address.

      iv. Lighting systems that do not support the above mentioned address patching capabilities shall not be suitable.

   c. The system shall allow assignable labels for all network devices to allow easy identification by system users.

   d. Each network device shall have a discrete and unique IP address provided automatically by the software. The user may edit this IP address. Systems that do not support automated IP allocation with IP collision avoidance, and systems that do not allow complete reconfiguration of the above mentioned features over ANSI E1.17 ACN shall not be acceptable.

   e. All configuration data for each network device shall be held at the device and system operation shall not require continuous on-line operation of the network configuration software.

   f. Lighting console operators shall be able to backup the network configurations in the lighting control console. In the event of a network device failure, the operator shall be able to apply the configuration of the failed device to a replacement device of the same type without manually reentering settings. Systems that do not support configuration backup as described above shall not be accepted.

   g. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over E1.31 Streaming ACN (sACN) level data. The system shall be capable of alternating control of individual address data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control. The network shall

allow user override of the selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be accepted.

h. The network shall allow multiple DMX input sources to be prioritized on the same universe as network native sources using E1.31 Streaming ACN prioritization. Multiple DMX inputs may be assigned to the same streaming ACN address (this provides multi-source control for a particular address). Likewise, the system shall support E1.31 prioritization of multiple simultaneous network sources. Systems that cannot prioritize multiple DMX inputs and multiple native network sources on a network shall not be deemed suitable.

i. The lighting network shall allow each DMX input address to be assigned a priority on the network allowing each DMX control level coming into the system to participate in full arbitration. Addresses with the highest priority shall have control, with lower priority addresses being ignored. Addresses assigned the same numeric priority, between 1 and 200, shall respond in highest level takes precedence (HTP) manor. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritized HTP for DMX inputs to the network shall not be allowed.

4. Operational Features

a. Each DMX gateway shall control up to 512 DMX addresses per port, within the confines of up to 63,999 DMX universes (32,747,488 address). The specific DMX data input or output by the gateway shall be configurable by the user.

b. Duplicate outputs of DMX data (DMX splitter) and discrete outputs shall be fully supported.

c. Merging of multiple DMX input sources on a single gateway with DMX output on the same gateway shall be supported without connection to the network. The gateway shall support assignment of priority to each input source independently

d. File transmission, synchronization and access to software shall be supported.

2.5 ARCHITECTURAL CONTROLS – DMX GATEWAY

A. Product: Response Mk2 Two-Port Gateway by ETC Inc.

1. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, WEEE.

2. Color: As determined by the Architect from the Manufacturer's offering.

3. Functional:

a. Supports Net3/ACN (ANSI E1.31 and E1.17), RDM (ANSI E1.20), USITT DMX512-A (ANSI E1.11).

b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.

c. Flexible Output Patch allows a 512-address universe to begin at any output address.

d. Advanced Input Patch.

e. Support for per-address- or per-universe-level priority.

f. Maximum delay time from input to output not greater than one packet time.

g. Selectable DMX refresh rate with a maximum at least 40 Hz.

h. Supports up to 256 total RDM devices.

4. Mechanical:

a. Intuitive four-button interface.

b. Onboard display for identification, status, and configuration.

c. Enclosed electronics assembly and faceplate.

d. No visible means of attachment.

e. Flush-mount in industry standard backbox, RACO 690 or equivalent. Surface-mount backboxes available

5. Construction: Injection-molded, ABS plastic.

a. Network and power activity LED indicators.

b. Blue power indicator, green network activity indicator,

c. RJ45 connector for connection to lighting network.

d. Reset button: For hard reset or forced reboot.

6. Environmental:

a. Ambient operating temperature: 32 to 104 degrees F.

b. Operating Humidity: 5 - 95 percent non-condensing.

c. Storage temperature: Minus 40 to 158 degrees F.

7. Electrical:

a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet

b. Power Input: 12-24 VDC for use with non-PoE systems.

c. Current Draw: Maximum 4 W.

8. Configuration:

a. Local configuration options.

b. Remote configuration by Net3 Concert.

i. Supports 512 DMX addresses per port.

ii. Supports 63,999 Streaming ACN universes.

c. DMX data input or output configurable by user.

d. Multiple sources may be combined to the network with each source or address allowed an independent priority.

e. Individual port start address and offset.

f. User-configurable labeling.

© BNA Consulting

PART 3 –THEATRICAL LIGHTING CONSOLE AND LIGHTING INSTRUMENTS

3.1 THEATRICAL LIGHTING CONSOLE – AUDITORIUM

A. Product: Ion XE 20 as manufactured by ETC Inc.

1. Model Ion Xe 20 2K: Ion Xe 20 console, 2,048 outputs (base)
2. Power consumption: Approximately 2 A at 120 V or 230/240 V.
3. Ambient Room Temperature: 32 to 95 degrees F (0 to 35 degrees C).
4. Ambient Humidity: Up to 90 percent non-condensing.
5. Regulatory Compliance: CE compliant, cETLus listed, UKCA marked, FCC compliant, RoHS compliant, and WEEE.
6. Hardware and Interfaces:
    a. Supports two external display port monitors (1920 x 1080 min, 3840 x 2160 max). Optional single-touch or multi-touch screen control and DDC/CI support.
    b. Twenty 45 mm standard faders, 100 10-fader pages configurable as channels, submasters, palettes/presets, timing, and effect rate/speed playback control.
    c. Two internal monochromatic LCD displays for fader content.
    d. Main Playback with two 100 mm standard faders.
    e. Four encoders for non-intensity parameter control.
    f. Dedicated high-resolution intensity level wheel.
    g. Backlit Eos keypad.
    h. Included USB keyboard.
    i. Solid-state hard drive.
    j. IEC Power Input: 100 to 240 VAC at 50/60 Hz, fused mains power switch, locking regionalized power cable included.
    k. Two individually configurable Gigabit Ethernet ports, RJ45 connectors.
    l. One 802.11ac Wi-Fi Ethernet adapter. To be enabled with future software.
    m. Bluetooth 5.1 for connecting input accessories. To be enabled with future software.
    n. sACN and Art-Net network output protocols.
    o. Four DMX-512 / RDM 5-pin XLR ports.
    p. Contact closure triggers via D-Sub connector.
    q. USB 3.1 ports, for flash drives, pointing devices, keyboards.
    r. USB-A Ports: 5. USB-C Ports: 2
    s. One Littlite XLR port.
    t. One Kensington lock port.

© BNA Consulting

u. Multiple MIDI and/or SMPTE timecode inputs, MIDI In and Out, Analog/Serial Inputs, OSC transmit/receive, UDP transmit/receive through network interface or Response Gateways.

B. SOFTWARE FOR ENTERTAINMENT CONTROLS (EOS)

1. Lighting Control Desk: A microprocessor-based system providing control of stage, studio, and entertainment lighting systems.

2. Console Model: Ion Xe 20 2k as manufactured by ETC Inc.

3. Output: Ion Xe 20 2k: 2,048.

4. The following items may be contained in non-volatile electronic memory and stored to an onboard solid-state hard drive or to any USB storage device.

   a. Cues: 100,000. Cue Lists: 999. Groups: 10,000. Presets: 10,000 presets. Palettes: 4 x 10,000 (Intensity, Focus, Color and Beam)., Macros: 99,999. Effects: 10,000. Curves: 10,000. Color Paths: 10,000. Snapshots: 10,000.

5. Recorded cue lists: May be played back simultaneously on up to 200 faders.

   a. HTP/LTP intensity flags, assert, proportional, intensity master or manual master fade control and priority status may be placed on each cue list.

   b. A cue list may contribute to playback background states or to withhold such contributions.

6. Channels: Are to, by default, respond to cue information by last instruction, with discrete rate control provided for all cues.

7. The desk may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.

8. Control and programming features for automated fixtures: Include the following.

   a. Standard library of fixture profiles. The ability to copy and edit existing profiles and create new profiles. Patch displays including channel and output addressing. 24-bit fade resolution. Color characterization allowing color mixing and matching to color media data.

9. Displays: Three user definable work spaces, providing individually configured frames, with size/scaling controls.

10. Help Feature: Context sensitive. Explain and provide operation examples of system features. To be integrated into the on-board user manual via hyperlinks.

11. A fully integrated Virtual Media Server feature shall allow the user to map images and animations to a rig array. Forty such maps may be created, each with twelve layers. Systems that rely on external hardware or software for this functionality shall not be acceptable.

12. Fully integrated 3D visualization and programming environment included. Includes tools for programming fixed-focus and moving fixtures, including ability for straight-line focus moves, click-to-focus, and integration with personal device apps that allow finding the devices' location in real space and automatically adjusting moving fixtures to point at the location. The 3D environment receives its data from the internal programming of the lighting controller, not by monitoring the output levels being sent to the lighting system. The 3D environment displays a replica of live output to the lighting system, and displays recorded states in Blind, for the user to preview and modify the lighting states without changing live output to the lighting system.

© BNA Consulting

13. Software Upgrades: By user via USB flash drive. Install software updates in all desks, processor units and video remotes from one device over the network.

14. The device operating software shall be loaded into program execution memory from the internal hard drive when the desk is powered. In the event of an uncontrolled shutdown, the device shall return to its last output state when power is restored. Devices requiring a UPS to provide such protections shall not be acceptable.

15. Output shall be distributed over a 100/1000/10000 Mbps Ethernet network using Streaming ACN (sACN), and/or Art-Net protocols. The user shall be able to control the application of protocols at an individual address level.

16. Output shall additionally be allowed via local ports utilizing the USITT DMX512-A output protocol, where the lighting console has these ports installed.

17. The system shall support full bi-directional RDM communication with compatible devices via ETC Net3 and Response DMX/RDM Gateways. RDM communication shall adhere to ANSII standard E1.20-2006 Entertainment Technology - RDM - Remote Device Management Over DMX512 Networks. Supported RDM features shall include:

    a. Discovery and Identification of RDM-capable devices.

    b. Setting of start addresses, operating modes and additional settings as exposed by connected devices and controllable via RDM.

    c. Viewing of sensor data as provided by connected devices.

    d. Error reporting as provided by connected devices.

18. Integrated power control monitoring features shall be provided to allow indication of power control system status, error states and circuit load monitoring. Adjustment of circuit configuration from the console shall also be supported. Communications with the power control system shall utilize ANSI E1.17 2006 Entertainment Technology Architecture for Control Networks.

19. Show data may be created and modified on a personal computer, using Windows 7 64-bit or higher operating systems, with a free offline editing application. The offline editor may also run natively on Macintosh platforms using OS 10.14 (Mojave) or later. The program shall also allow output to visualization software supporting the same protocols as the lighting system, without the need for additional keys or hardware. Systems that do not offer visualization output from a personal computer without additional keys or hardware shall not be acceptable.

20. PC: Windows 7, 64-bit or higher. Macintosh computer: OS 10.14 running a client software application. Connect to a control system via the network and view or modify current show data in an independent display environment, using an ETCnomad license key. When connected without the key, the computer shall operate in Mirror Mode, with the device to be mirrored selectable by the user.

21. Synchronized backup shall be provided via another full desk on the network, a processor unit or a PC/Mac using ETCnomad. The backup unit shall maintain synchronized playback with the host controller and shall take over control of the lighting system upon loss of communication with the host controller, either automatically or upon user confirmation. Use of two processor units to service and backup system output is also supported.

22. A maximum of 99 users may access and interact with show data simultaneously. Each user shall have an individual workspace. User identification may be assigned to more than one control device, allowing users to work in tandem, or allowing a designer/ALD to mirror the current display format, mode, and

© BNA Consulting

command line of the associated programmer. Partitioned control allows discrete control of channel/parameter groupings by user. Partitioned control may be easily enabled and disabled with no need to merge show data from multiple users.

23. Show files are saved across the system to all available integral hard drives simultaneously.

24. Support 32 individual simultaneous Time Code inputs or Event lists.

25. Controls and Playback:

    a. Manual Control and Programming Section:

        i. The programming keyboard shall be grouped by function. Major groupings shall be recording target functions, numeric keys, level assignment functions, display navigation functions and controls, as well as non-intensity parameter controls.

        ii. The command keypad shall be fully interactive with the virtual controls, such as color pickers and direct selects. The command keypad shall allow navigation of virtual fields on displays and in dialogues, reducing the need for a pointing device.

        iii. Provide direct select virtual controls, which provide "one touch" selection of channels, groups, palettes, presets, effects, snapshots, magic sheets, and macros. Labels and icons may be applied to the targets for quick reference, with a stock library of common images included, and custom images easily importable. The user shall be able to create custom direct selects, with any arrangement and combination of controls.

        iv. Non-intensity parameters may be set numerically via an extensible keypad on the main display. This control shall be fully interactive with the page-able encoders. The display associated with the encoders shall display the current encoder function. The touch screen shall also access available modes for each parameter type, min, and max values for each parameter as applicable, as well as home position on a parameter basis.

        v. Only those parameters available for control in the active lighting system shall be displayed for control. Displays shall lowlight parameters not available to selected channels. Alternatively, the encoders may be placed in a state allowing parameters not applicable to the current selection to be suppressed.

        vi. Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a "control channel" for accessing these functions shall not be required and systems requiring use of control channels for these functions shall not be acceptable.

vii. Fan functions shall be provided both via command line operation and through encoder controls.

viii. Highlight shall be supported, with user definable highlight values. Lowlight conditions may be defined for selected, but not specified channels. Rem Dim commands, at specific levels by channel, may be optionally and automatically called with the highlight command.

ix. Fixtures with color mixing may be set with direct additive or subtractive encoder controls or the command line, as well as via the color pickers. Six optional color spaces are supported, as well as tinting tools, and spectrum tools for systems with more than two color mixing elements. Color may also be set directly to a gel match via a graphic selection tool or from the command line. The gel picker shall support tools for identifying similar colors, show favorites, and graphic indications of gel locations. Color Path tools, with intensity dampening, shall be provided.

x. The Virtual Media Server function shall allow the user to create two-dimensional layouts of devices, identified as pixel maps. Media content (images, movies, text, and procedurally generated effects) may then be applied, manipulated and stored. Stock content is provided and the user may import custom imagery and animations.

xi. Macros shall allow the user to create strings of commands, and replay them manually or triggered by a cue, a submaster, or an outside source via OSC or sACN input. By default, macros triggered manually shall post to the command line, but those executed via cue lists shall run in the background. The user may override this behavior by defining the macro to always execute in the foreground or background, regardless of the recall method. Startup, Shutdown and Disconnect macros may also be defined.

xii. Playback Section

xiii. Up to 1,000 playback faders may be defined on the fader array, on pages of ten faders each.

xiv. Faders may be grouped for playback, with sliders and button action defined by the user.

xv. Instantaneously halt an active cue, back to the previous cue, manually override the intensity fade or manually override the entire fade or go to a cue at a specified percentage of completion.

xvi. Cue list to contribute to background state or for the contents of each cue list to be withheld from such.

1. Priority and background priority states may be established.

xvii. Playback Faders: To have the following associated controls:

1. Freeze: Halts fader output
2. Stop Effect: Stops action of an effect.
3. Filter: Assigns fader filter states.
4. Go To Cue 0: Reset a cue list.
5. Off: Turns off contents of a playback, releasing control to the background state or to set to null.
6. Assert: Replays an active cue.
7. Release: Releases control to background and resets the cue list.
8. Timing Disable, channel filters and independent status may also be defined.
9. The potentiometer shall be configurable as a proportional master, an intensity master, or manual master. Support for rate, effect rate, effect size and Master Only controls is also provided. Filtered manual timing masters and effects masters may be configured.
10. Rate Override / Fader Paging: Supported with associated controls.

b. Submasters:

i. Up to 999 proportional, fully overlapping additive, effect or inhibitive submasters may be defined. Submasters shall use system-defined colored graphics and LEDs (where available) to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Submasters may be set to priority and background priority status.

ii. Submasters may be set to HTP or LTP intensity. Non-intensity parameters on submasters shall be LTP only.

iii. Exclusive mode for a submaster shall prohibit the live contribution of that submaster from storing to cues or other submasters. Shield mode prohibits access of associated channels from any other playback or manual control operations.

iv. A submaster potentiometer may be defined as proportional, master only or intensity master. When set as an Intensity Master, a mark and unmark feature is supplied.

v. Motorized faders shall set submasters to required positions as fader pages are changed. Upon a page change, non-motorized faders shall blink the associated indicator LED, and display an arrow graphic to indicate the direction the user must move the fader to match the newly mapped content. The user shall not gain control of the content until the non-motorized fader has matched the content's value.

© BNA Consulting

vi. The submaster blind buffer shall be linked directly to live playback.

vii. Set submaster values directly from the command line.

viii. LTP submasters may be set to fade to background or to minimum value when the fader is returned toward zero.

ix. Submaster values may contribute to the background state or be withheld.

c. Grand Master Fader

i. The location of the Grand Master shall be user definable. The grand master shall have associated blackout and blackout enable buttons.

ii. Blackout shall send all associated intensity outputs to zero. Non-intensity outputs shall not be affected.

iii. Lighting control devices with motorized faders shall set the grand master to required positions as fader pages are changed.

iv. If the Grand Master Fader is set below 100 percent, the system shall display a virtual fader on all monitors, for access when the Grand Master is located on a fader page that is not visible.

26. Display Controls:

a. Format shall change the view of selected displays.

b. It shall be possible for the user to choose which parameter categories or parameters they wish to display. Parameters and categories shall have adjustable column widths.

c. Flexichannel modes shall change which channels are viewed in selected displays, as follows:

i. No modes

ii. Parent channels only / cell channels only

iii. Use Partitions

iv. Flexichannel states shall change which channels are viewed in selected displays, modified by the flexi modes, as follows:

1. All channels
2. Patched channels.
3. Show channels.
4. Active/Moved channels.
5. Selected channels.
6. Manual Channels.
7. View channels (user identified list).
8. Channels with discrete timing.

© BNA Consulting

d. Expand shall extend the selected view sequentially across connected displays.

e. "Time" depressed shall display discrete timing data. "Data" suppressed shall display absolute values of referenced data. These controls may be latched.

f. Displays may be toggled to show stored data currently manually overridden, the source of the current parameter data, output level, patch assignment, part structure and referenced marking data. These controls may be latched.

g. User definable magic sheets shall provide alternative display of and access to channels and record targets. Multiple magic sheets may be created, each with a variety of zoom and placement factors for rapid recall of the required view. User-definable, interactive displays may be created. These displays, which can be used in live and blind operating modes, allow graphical layout of channels, desk buttons and programming tools. Standard symbols are provided, and the user may import their own symbols or graphics. Each symbol may be individually defined with data feedback characteristics. Non-interactive status information, such as a mirror of other user's command lines, may also be included in the display. A graphical browser is provided for fast selection of these views. Multiple zoom factors and placements may be stored and recalled for each display.

h. Playback status displays are provided with a variety of different formats. Indications are provided per cue for live moves (lights fading from zero and moving non-intensity parameters) and dark moves (inactive lights which have stored non-intensity parameter moves). The user may select a static or dynamic time display in the cue list itself.

i. Display content including which of the workspaces is in focus on any of the monitors and what views are docked in those workspaces may be instantly recalled using snapshots.

27. Operating Modes

a. Live Mode

i. Channel lists may be constructed using the +, -, and Thru keys as well as the direct selects. Channel selection is fully interactive, regardless of the method used.

ii. Levels may also be set with the keypad, level wheel and non-intensity encoders. "Selected" channels shall be those last addressed and under keypad control. Controls are provided for single button access to the last selected channel list, all channels with manual levels and all active channels.

iii. Channels may be set at a user defined default level using the Level key. + percent and percent keys adjust channels quickly by user definable values.

iv. Channels and/or channel parameters may be captured. Capture mode shall allow the user to selectively capture channel data at specific levels. Captured data shall be indicated on the Live display.

© BNA Consulting

v. Sneak is used to restore specified channels to background states, default values, or send them to specified values, in user specified times.

vi. Selected channels may be set at a level or held to current values while other channels are set to zero using Rem Dim. Toggling Rem Dim restores unselected channels to original levels. The Rem Dim level shall be user definable via the command line or with a default setup value.

vii. Channels may be recorded into groups for fast recall of commonly used channels. 10,000 groups shall be available. Groups shall store selection order and subgrouping functions. The Offset function supports rapid creation of ordered groups, including reverse and random order.

viii. Parameter Settings: Stored to Intensity, Focus, Color, Beam Palettes, and to Presets. Referenced data may be stored to whole numbers or up to thousandths decimal places between each whole number.

ix. The following conditions may be placed on a channel or channel parameter to be included with a cue record action.

1. Discrete fade time and/or delay.
2. Block flag.
3. Assert flag.
4. IFCB Filters, which may be set at a parameter level.
5. Release and restore.

x. 999 cue lists may be stored. Cues may be recorded in any order. Up to thousandth decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts.

xi. It shall be possible to record cues and cue parts with the following information:

1. Any collection of channel data, as determined using "Record", "Record Only" or selective store commands, combined with parameter filters - including Effects.
2. Cue Level timing and delays for Intensity Up, Intensity Down, Focus, Color and Beam.
3. Follow or hang time.
4. Link instruction.
5. Loop value.
6. Block, Assert, Preheat, Release, and/or Mark Flag.
7. Curve.

© BNA Consulting

8. Rate.
9. Allfade.
10. Label and note.
11. Alert countdown time.
12. Timecode playback stamp.
13. Scene label (cues only, not cue parts).
14. Execute commands to trigger other activity (execute cue lists, cues, macros, snapshots, OSC and UDP strings, and MIDI raw commands).
15. Cue list partitions shall be available to filter list content.

xii. Channel parameters may be stored with an effect instruction. Effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive actions or on/off states. Entry and exit behaviors modify the channel parameters activity when beginning and ending the effect. Channel and cue level overrides are provided.

xiii. Non-intensity channel parameters may be marked (pre-set), in two ways. Automark pre-sets any parameter transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a "live" move. Alternatively, non-intensity parameters may be marked to a specific cue with a single command instruction. It shall not be necessary to store or update these parameters directly into the cue in which the movement is to occur.

xiv. Update may be used to selectively add modified parameter data quickly to that parameter's current source. Trace may be used to modify the data to the original source of its move instruction. It shall be possible to update inactive record targets. A context sensitive display provides detailed information regarding the results of the update command.

xv. Recall From quickly pulls specified data from record targets or other channels into the current view. Recall on an HTP basis shall be provided.

xvi. Copy To quickly copies selected data to specified channels or other record targets.

xvii. Address and channel check functions shall be provided.

xviii. Channel parameters may be "parked" at levels. Those levels are not added to any live record operations, nor may they be changed until the parked element is "unparked". Scaled park provides real time proportional adjustment of stored intensity values. Address Park shall also be provided.

© BNA Consulting

xix. About shall provide detailed status of selected channels or specified record targets. This shall include current source, current value, discrete timing, parked value, marked to and for indications. Background levels and current DMX output are also displayed. Channel usage indicates submaster and cue information and provides a "dark moves" report on a per channel basis.

xx. 10,000 snapshots may be stored which instantly recall specified front panel and display configurations.

xxi. Query shall allow selection of channels by their current or possible state. Keywords and fixture types shall allow quick access to fixtures.

xxii. User definable home positions, on a per channel basis, may be defined.

xxiii. Undo shall be used to sequentially step back through manual operations or to undo record and delete actions. It shall be possible to undo multiple commands in one action.

b. Blind Mode

i. The Blind display allows viewing and modification of all record targets without affecting stage levels.

ii. Record target data may be displayed in a summary view, a detailed table orientation or a spreadsheet view, which allows quick data comparisons, move, and replace functions.

iii. Changes to blind data shall be automatically stored. Range selection of both record targets and channels shall be supported.

c. Staging Mode

i. Staging mode shall allow temporary changes to be made to the lighting system, which are only displayed on Live and Blind displays and represented in the 3D environment, without changing the live output to the lighting system, so that the user may preview changes before committing them to output.

ii. Staging mode shall be accessible in Live or Blind mode, and the user shall be able to abandon or commit changes to the live output or to the stored database separately. The user may leave Staging mode, and the buffer shall remain until the user clears the changes.

d. Patch Display

i. Patch shall be used to display and modify the system control channels with their associated library data.

ii. Each channel may be provided with a proportional patch level, curve, label, swap and invert functions, Live/Dark flag enable/disable, as well as keywords to service Query.

iii. A full library of profiles is provided, with the ability for the user to define "favorites" for fast selection. The user may also modify library profiles or create new profiles, to function with any controlled device.

iv. Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a "custom" footprint for any device output.

v. Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.

vi. The user may define or modify color configuration for parameters of color-changing fixtures, allowing the color picking tools to accurately control a fixture's color system.

vii. RDM discovery, patching and device monitoring shall be supported.

viii. Copy to, Swap and Move functions shall be supported in patch.

e. Setup/Browser:

i. Access system, user, and device configurations.

ii. Possible to partially merge show files. Users may select as much or as little of the show file as required, with renumber tools.

iii. Import ASCII and Lightwright data files. Export as ASCII or .csv.

iv. Access for show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.

v. Support programming and playback of real time clock events, including cue, submaster and macro execution at specific times of specified days or at a time based on astronomical events.

vi. Control screen: For network configuration, selecting date/time, software update controls, selecting functional language and/or keyboard for labeling option, and other system level tools.

vii. Languages for prompts, advisories, and help: English, Bulgarian, German, Spanish, French, Italian, Polish, Slovenian, Russian, Japanese, Chinese simplified, Chinese traditional, and Korean.

viii. Supported keyboards: Latin American, American International, United Kingdom, French, German, Italian, Korean, Norwegian, Russian, Slovakian, Turkish, Swiss, Swedish, Finnish, and Bulgarian.

28. Output and Integration of Power Control Monitoring and Configuration:

a. Lighting Control System: Provides communication with an ETC Sensor+ and Sensor3 dimming systems for remote monitoring and configuration of show specific functions from within the software application.

b. Circuit Level Configuration and Monitoring Functions Not Limited To:

i. Control mode (dimmable, switched, latch-lock, always on, off or fluorescent).

ii. Curves.

iii. Control threshold.

iv. Min and Max Scale Voltage.

v. Preheat.

vi. Scale load.

c. Rack status messages Not Limited To:

i. State of UL924 panic closure

ii. DMX port error/failure

iii. Network error/failure

iv. A, B, C Phase below 90 or above 139 volts and headroom warning

v. Ambient temperatures out of range

d. Circuit status N limited to:

i. Module type and location

ii. Output level

iii. Control Source

iv. Overtemp

e. Advanced circuit feedback Not limited to:

i. Load higher or lower than recorded value.

ii. DC detected on output.

iii. SCR failed on/off.

iv. Breaker trip

v. Module has been removed.

vi. Load failure

f. Shutdown due to Overtemp.

3.2 ENTERTAINMENT LUMINAIRES

A. Basis of Design: ColorSource Spot V as manufactured by ETC Inc. Brings together a five-color light engine with the build-quality and support of an ETC product. Uses a mix of red, green, blue, indigo and lime LED emitters. ETC optics, adapters, and accessories.

1. Standards Compliance:

a. Listed: cETLus, UL 1598, UL 924, CSA C22.2 No. 250.0.

© BNA Consulting

b. Compliance: CE.

2. Model ColorSource Spot V with shutter barrel, black.

3. Source:

   a. LED Details: 60 Lumileds LUXEON Rebel and LUXEON C LEDs.

   b. Max Lumens: 9300.

   c. Lumens per Watt: 47.2.

   d. L70 Rating: Greater than 54000 hours.

4. Colors:

   a. Colors Used Spot: Red, green, blue, indigo, lime.

   b. Color temperature Range: Color mixing.

   c. Calibrated Array: Yes.

   d. Red Shift: No.

5. Optical:

   a. Beam Angle Range: 5 to 90 degrees. Swappable lens tubes.

   b. Gate Size: 80 mm.

   c. Aperture Size: 6.25 to 14 inches depending on lend tube.

   d. Pattern Projection: Yes.

   e. Pattern Size: A or B.

   f. Camera Flicker Control/Hz Range: 5 kHz and 25 kHz.

6. Control:

   a. Input Method:

      i. DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.

      ii. City Theatrical Multiverse. Protocols: DMX512, RDM

   b. NFC Configuration: Yes, via Set Light app.

   c. RDM Configuration: Yes.

   d. User Interface Type:

      i. ColorSource Spot V: 7-segment 3 button interface.

   e. Local Control: Yes. (ColorSource Spot V only)

   f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.

   g. Fixture-to-Fixture Control: Yes.

   h. 15-bit virtual dimming engine.

7. Electrical:

   a. Voltage: 100 to 240 VAC, 50 to 60 Hz.

   b. Input Method: powerCON True1 TOP in and thru.

   c. Inrush First Half Cycle: 55 A at 120 V. 59 A at 240 V.

   d. Fixtures per Circuit:

© BNA Consulting

i. Eight. (R20 module or similar).

e. Power Draw

i. Wattage: Typical: 197. Standby: 2 at 120 V.

8. Thermal: Operating Temperature: 32 to 104 degrees F.

a. Fan: Yes. Controllable.

b. Droop Compensation: Yes.

c. BTUs/hour: 671.77.

9. Physical: IP Rating: ColorSource Spot V: IP-20. ColorSource Spot VXT: IP-65

a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.

b. Mounting Options: Yoke.

c. Included Accessories: Hanging yoke, 39 inch power cable, soft-focus diffuser in an A-size gobo holder.

B. Provide the following for the Auditorium:

1. THEATER ELIPSOIDAL FIXTURES:

a. 16 - ETC CSSPOTS – ColorSource Spot V 25°-50° LED Spotlight(s) complete with “C” clamp, color frame, safety cable, 1M lead with 20A Stage Pin connector and 10’ DMX cable.

2. THEATER FIXTURE ACCESSORIES:

a. 16 - 400PH-B - Pattern holder (B size)

b. 4 - 400PH-G - Glass pattern holder

c. 5 – 5’ DMX cable

d. 5 – 15’ DMX cable

e. 2 – 20’ DMX cable

f. 4 – Clip lights with blue bulbs for use as run lights in the booth.

PART 4 - EXECUTION

4.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

A. Install a complete stage lighting and dimming system and components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

B. Employ the services of a Factory Authorized Theatrical Dealer/Integrator for complete theatrical systems/fixture purchase and project coordination. Dealer/Integrator shall provide the following services:

© BNA Consulting

1. Attendance at prebid walkthrough(s) to answer questions about theatrical systems.
2. Coordination with electrical contractor throughout full term of project.
3. Review all theatrical low voltage terminations made by the electrical contractor.
4. Review the complete theatrical system(s) prior to energization and supervise the energization of system.
5. Complete programming of the system including all button stations and touchscreens and to ensure all architectural fixtures are dimming smoothly and flicker free down to 1%. Two additional site visits shall be provided after the building has been turned over, at six months and one year, to make any changes to the programming that may be required by the Owner.
6. Theatrical fixture assembly and bench focus prior to hang.
7. Initial hang and focus of theatrical fixtures per engineer's/owner's requirements.
8. Contractor shall be theatrical installer shall be present at the first tech rehearsal and first performance using the system within Auditorium. Owner will coordinate with contractor 3 weeks in advance for personal trained on the system to help with the show and be onsite in case there are any problems. The theatrical installer shall provide this within their bid.

C. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

D. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work. Contractor shall be on site as required, to adjust lighting control units for proper light levels as directed by engineer.

E. Provide all required drawings for each system identified; show all hardware configurations, panel required schedules and numbering. All panel wiring diagrams and typical wiring diagrams for each component.

4.2 FIELD QUALITY CONTROL:

A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

4.3 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for start up, testing and operating lighting control system equipment. Provide video recorded training for Owners Use

END OF SECTION 26 5561

BLANK PAGE

© BNA Consulting

SECTION 27 1500

TELEPHONE/DATA SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF DOCUMENT:

A. The following are project specifications that all cabling systems must adhere to. These specifications apply to all installers (hereinafter referred to as "the Contractor") for all sites, that require, standards-compliant structured cabling systems and shall be used for all the installation, testing, and acceptance of the information transport systems as described in the attached specifications. Prices quoted of the installation facilities shall be all-inclusive and represent a complete installation at such sites as prescribed in this specification and contract documents. The Contractor shall be solely responsible for all parts, labor, testing, acceptance and all other associated processes and physical apparatus necessary to turn-over a completed system fully warranted and operational for acceptance by the Customer. Final acceptance of the installation shall be in writing by the Architect and Engineer.

B. In all instances where Standards are cited, it is assumed Installer will have familiarity with and implicitly follow the recommendations of the most current version of the Standard referenced at the time of installation. Compliance with most current Standards is the sole responsibility of the Contractor.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-7 Firestopping, apply to work of this section.

C. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.3 SCOPE OF WORK:

A. The extent of telephone/data system work is indicated by drawings and is hereby defined to include, but not be limited to racks, cabinets, patch panels, cables, raceway, outlet boxes, device plates, backboard, and grounding. Contractor is responsible for installation of all specified and unspecified necessary and miscellaneous items required for delivery of a complete and functional data cabling and device system.

B. Contractor shall provide complete cable and outlet system as indicated on the drawings and described herein. Work shall include all associated infrastructure transmission components and support appliances including, but not be limited to cable, jacks, terminal blocks, racks, cabinets, wire management, labeling, transient voltage surge suppression, patch cords, telecommunications grounding system and all terminations as specified herein.

C. Contractor shall provide system testing as described herein using up-to-date and industry accepted Level IIIe, IV, V test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1. All testers used shall be factory calibrated within one year of use with references set daily prior to testing.

D. All active equipment (electronics) will be owner furnished and owner installed.

E. Contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn-over the completed system fully warranted and operational for acceptance by Owner and Engineer.

F. Contractor shall provide all labor, materials, tools and equipment required for the complete

installation of work called for in the Construction Documents.

G. Copper solution must match optical fiber solution and be provided by the same manufacturer. No two separate warranties are acceptable for the copper connectivity and optical fiber connectivity.

H. Contractor shall provide 1-1" EMT conduit from telecommunications outlet/connector to EF/ER/TR/TE.

1.4 CONTRACTOR QUALIFICATIONS

A. The contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to voice and data network systems. The Contractor shall at a minimum possess the following qualifications:

1. Must have at a minimum (1) RCDD certified individual employed full time at the time of bidding and throughout entire project. **PROVIDE PROOF OF RCDD CERTIFICATION IMMEDIATELY UPON JOB AWARD**.
2. Approved and certified by connectivity manufacturer. Provide proof of certification immediately upon job award.
3. BICSI Certified Installers or equivalent.
4. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
5. Have a minimum of 5 years in the communications structured cabling business and be able to provide three owner references for the type of installation described in this specification for projects within the last 18 months.
6. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must own not rent a light meter or fiber test adapter head, and OTDR and shall be factory certified by the manufacturer of the products being installed.
7. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
8. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
9. Be factory certified by the manufacturer used in installation of all transmission components of all copper and fiber links and able to provide the manufacturer warranty.

1.5 QUALITY ASSURANCE

A. Required Pre-Telecommunications Construction Meeting with Communications Engineer: Electrical contractor/representative AND Communications Contractor will be required to attend a pre-communications construction meeting (approximately 30-60 minutes) with Communications representative in the electrical engineer's office prior to communications construction commencement. This meeting will address any questions on the part of the contractor and the expectations of the Engineer with regard to specifications, plans and site visits for both rough and finish electrical work.

B. Owner IT Contact:

1. **Cameron Chugg, chuggc@ogdensd.org, 801-737-8827**

C. BNA IT Contact:

1. **Brian Hicks RCDD; bhicks@bnaconsulting.com, 801-532-2196**

© BNA Consulting

2. **Son Nguyen; snguyen@bnaconsulting.com, 801-532-2196**

1.6 APPLICABLE CODES AND STANDARDS

A. Contractor is responsible for compliance with all applicable portions of the NEC code as to type of products used and installation of components. All materials used shall be products and materials that have been UL-listed and labeled. All installed products shall comply with applicable NEMA standards for low loss extended frequency cable.

B. In addition, installation shall adhere to the following Standards:

1. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises, or most recent edition at the time of installation
2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standards, or most recent edition at the time of installation
3. ANSI/TIA-568-C.2 - Balance Twisted Pair Communications and Components Standards, or most recent edition at the time of installation
4. ANSI/TIA –942 -Telecommunications Infrastructure for Data Centers, or most recent edition at the time of installation
5. TIA-569-B - Commercial Building Standard for Telecom Pathways and Spaces, or most recent edition at the time of installation
6. ANSI/TIA-606-A – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, or most recent edition at the time of installation
7. ANSI/NECA/BICSI-607 - Commercial Building Grounding/Bonding Requirements, or most recent edition at the time of installation
8. ANSI/TIA 1152 – Testing of Copper Links
9. BICSI Telecommunications Distribution Methods Manual, 13th edition or most recent edition at the time of installation.
10. TIA 758-A - Customer owned Outside Plant Telecommunications Infrastructure Standard (2004), including all applicable addenda and the most recent revision at the time of installation.
11. BICSI Information Transport Systems Installation Manual - 5th edition or most recent edition at the time of installation.
12. ANSI/NFPA-70 - 2017 National Electrical Code, revision, or most recent revision at the time of installation.
13. ANSI/IEEE C-2 - 2017 National Electrical Safety Code or most recent revision at the time of installation.
14. OSHA Standards and Regulations All applicable
15. Local Codes and Standards All applicable

C. Note: Anywhere cabling standards conflict with electrical or safety codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either. Knowledge and execution of applicable codes is the sole responsibility of the Installer. Any code violations shall be remedied at the Contractor's expense.

1.7 ACCEPTABLE MANUFACTURERS:

A. General:

1. Unapproved product substitutions are not allowed. Contractor wishing to substitute any products for those expressly specified shall submit three samples of the

© BNA Consulting

alternate product to Engineer no less than two weeks prior to the last addendum accompanied by all engineering documents, drawings and third party test data proving mechanical and transmission equivalency. Acceptance of substitutions shall be received from Engineer in writing. All unapproved substitutions installed shall be removed by Contractor who shall assume all costs for removal and replacement with approved products. Such costs shall include, but not be limited to labor, materials, as well as any penalties or fees for late completion.

B. APPROVED MANUFACTURERS:

1. Contractor shall select only one line item in the each section of Parts 2, 3, and 4. Contractor shall NOT utilize multiple line items for the project within each Part. For example, if Panduit / General Cable is selected to be used for the project, all copper cabling and connectivity shall be by Panduit or General Cable. No other manufacturer or combination of manufacturers may be used for the copper cabling or connectivity equipment.

2. Copper Cabling / Connectivity Approved Manufacturers:

a. CommScope

b. Hubble

3. Fiber Cabling Approved Manufacturers

a. Same manufacturer from Part 2.

b. Corning

4. Non-Cabling / Connectivity Approved Manufacturers:

a. Same manufacturer from Part 2.

b. Chatsworth

1.8 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All products shall be in new condition and UL listed.

B. Provide complete raceway, outlet boxes and miscellaneous items. All conduit utilized shall be EMT grade.

C. Provide 5” x 2.875" (or 4-11/16” x 3.25” square) deep square outlet box at each outlet location with single gang plaster or tile ring. Provide wall board adapters / accessories as necessary.

1. Approved solutions:

a. RANDL 5 Square Telecommunications Outlet Box Model TX-550-YY where “X” could be a bracket box and “YY” could be knockout arrangements.

b. Hubbell Large Capacity Wall Box Model HBL260. If a 2” knockout is required for installation purposes, provide this box.

D. Communication grounding and bonding shall be constructed and installed to meet or exceed the requirements of the National Electrical Code (NEC), IEC 1000-5-2 and ANSI/J-STD--607-A throughout the entire grounding system.

E. All termination hardware shall be rated to meet specified cabling specifications.

© BNA Consulting

2.2 ENTRANCE FACILITY (EF) / EQUIPMENT ROOM (ER) / TELECOMMUNICATIONS ROOM (TR)

A. General:

1. Contractor shall be responsible for the adequate and appropriate design of all racking systems, paying particular attention to sizing of all cable management troughs and supports both horizontal and vertical installation of patch panels and wire management into rack.

2.3 CABLING DISTRIBUTION SYSTEMS AND MISCELLANEOUS EQUIPMENT

A. General:

1. Provide plenum rated cable/connectors if required, cabling/connectors must be appropriate for the environment that it is installed in. Provide wet rated cable for all wet locations, including any conduit in or below slab on grade.
2. Contractor shall be responsible for sizing all pathways such that newly installed cable represents not more than a 35% fill as per manufacturer's directions. Overfilled pathways are the sole responsibility of the Contractor who shall remove and reinstall at Contractors expense.
3. Provide products rated for the environment that it is installed in (i.e. riser, plenum, outdoor). All cabling installed in wet locations (i.e. underground conduit, conduit in slab on grade) shall be listed for use in wet locations.
4. General:
   a. Provide appropriate number of Category 6A horizontal cables, patch cables, work area cables, for all terminated data drops, between switches, etc. so that building-wide networking will be operational once all installation is complete.
5. Horizontal Cabling
   a. Provide Cat 6A UTP, min-compliant, 4-Pair 100Ω Balanced Twisted Pair Cable to all locations shown on plans.
   b. Provide cabling rated for the environment that it is installed in (i.e underground conduit, conduit in slab on grade). All cabling installed in wet locations shall be listed for use in wet locations.
   c. Provide a minimum of (2) cables, unless otherwise noted, to each location shown on plans.
      i. Provide (2) Category 6A cables to each wireless access point (WAP).
   d. Coordinate horizontal cable color with the owner.
   e. Approved Equipment

Cat 6A		
Manufacturer	**Model**	**Plenum**
CommScope	Uniprise	UN874035114/10
Hubble	Nextspeed	HC6AFTPSPx

6. Patch and Work Area Cables:

© BNA Consulting

a. Owner Provides

7. Telecommunications Outlets/Connectors (See Plans for Locations):

Faceplates:

i. Provide modular type information outlets with sloped telephone jack or data outlet. Provide single gang faceplate kits to allow up to six data or voice jacks as shown o HC6AFTPSPW n plans. Provide faceplate kits for wall outlets in colors and materials that match power wiring device plates. Provide faceplate kits that allow labeling schemes described herein. Faceplates shall accept STP, UTP, fiber optic or audio/video modules as an option.

ii. Blank off all unused ports.

iii. Color: Standard color as selected by owner/architect.

a. Connector:

i. Color: Standard color as selected by owner/architect.

c. Approved equipment

Connector		
Manufacturer	**Model**	**Connector Cat 6A**
CommScope	GigaSPEED XL	MGS600-xxx
Hubble	HC6AFTPSPW	HJU6Axx

Flat Plate		
Manufacturer	**Model**	**Plastic Faceplates**
CommScope	GigaSPEED XL	M1XI-262
Hubble	HC6AFTPSPW	IFP140W

PART 3 – EXECUTION

3.1 GENERAL

A. Prior to pathway rough-in, low voltage contractor shall meet with electrical contractor to review pathway installation requirements.

B. Pathway Requirements:

1. General:

a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.

b. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. Field coordinate alternate pathway requirements with other trades onsite. New pathways shall not exceed distance limitations defined within this

© BNA Consulting

specification. Notify the Engineer of the changes for final approval prior to proceeding with the change.

2. Conduits:

   a. For any interior/exterior conduit 4" and larger, provide (3) 1.25" plenum-rated corrugated innerducts.

   b. Flexible conduit is not acceptable as cable tends to creep, shift, or have sheath damage.

   c. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.

   d. Conduit runs shall not have continuous sections longer than 100 feet without a pull box and may only be filled to 35% capacity.

   e. Ream all conduit ends and fit with an insulated throat nylon bushing with non-indenter type malleable steel fittings to eliminate sharp edges.

   f. Telecommunications conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.

   g. Conduits that enter an EF/ER/TR must terminate near the corners to allow for proper cable racking. Terminate these conduits as close as possible to the wall where the backboard is mounted to minimize the cable route.

   h. Terminate conduits that protrude through the structural floor 1" to 3" above the surface within an EF/ER/TR.

   i. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.

   j. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.

   k. When the number of conduits requires more than one row, restrict the number of rows to two wherever practicable.

3. Pull Box Requirements:

   a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.

   b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90-degree bends, or contain a reverse bend.

   c. Conduits that enter the pull box from opposite ends should be aligned.

   d. Pull boxes shall have a length 12 times the diameter of the largest conduit.

   e. All pull boxes must be accessible.

C. Cabling System:

1. Follow T568B scheme for copper cabling terminations.

2. Life Safety Related Cabling:

   a. Provide the specified category cabling in 1" conduit from elevators and or lifts. Cabling shall terminate at telephone service demarcation point. .

   b. Provide the specified category cabling in 1" conduit for two phone lines to the fire alarm control panel back to telephone service demarcation point.

© BNA Consulting

c. Provide the specified category cabling in 1" conduit for the two-way communication system Main Control Panel back to telephone service demarcation point.

3. Miscellaneous Related Cabling:

   a. Provide the specified category cabling in 1" conduit for two data connections to Intrusion Detection System head-end back to EF or demarcation room. Refer plans for exact locations.

   b. Provide the specified category cabling in 1" conduit for two data connections to Access Controls System head-end back to closest data rack. Refer to plans for exact locations.

   c. Provide the specified category cabling in 1" conduit for one data connection to Intercom head-end back to closest data rack. Refer to plans for exact locations. Provide specified category cabling and conduit between intercom head-end and access control panel.

   d. Provide the specified category cabling in 1" conduit for Main Building Management System (ATC Panels, etc) back to nearest ER/TR room. Refer to Mechanical plans for exact location.

   e. Provide the specified category cabling in 1" conduit for Advanced Energy & Power Metering System back to Main Building Management System Panel. Refer to plans for main switchboard location.

4. It is acceptable to install innerduct within cable tray as long as the fill ratio is not exceeded.

5. Provide a minimum of one balanced twisted pair cable to each voice outlet and one balanced twisted pair cable to each data outlet shown on the drawings unless noted otherwise on the drawings.

6. Service Loop Requirements

   a. Provide a minimum 6" service loop in each communications system junction box for balanced twisted pair. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.

   b. Provide a minimum 10' service loop in each EF/ER/TR/TE.

   c. Provide a minimum 2' service loop at each stub-up or at each transition from conduit to cable tray.

   d. Provide a 5' service loop in the ceiling before the conduit travels down the wall and terminates into the communications junction box.

   e. Provide a 25' loop at all wireless access point (WAP) locations above the ceiling.

7. Provide modular jacks for each installed cable at outlets shown on drawings. Blank off all unused ports on faceplate.

8. Provide Velcro type ties for all cables and install in a neat and workmanlike manner. Where applicable, use plenum rated Velcro. Where cable is installed in cable tray, bundle a maximum of 25 cables in each Velcro tie. No zip ties are permitted whatsoever, even for temporarily hanging cables during the installation process

9. The bending radius and pulling strength requirements of all backbone and horizontal cables shall be observed during handling and after installation. Use pulling compound as recommended by manufacturer.

© BNA Consulting

10. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.

11. The combined length of all patch cords in the EF/ER/TR and the work area shall not exceed 10m (33 ft)

12. No splices are allowed.

13. In a false ceiling environment, a minimum of 3 inches shall be observed between cable supports and false ceiling. At no point shall cable(s) rest on acoustic ceiling grids or panels.

14. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

15. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

16. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

17. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.

18. Pair untwist at the termination shall not exceed 0.125". The cable jacket shall be maintained as close as possible to the termination point.

19. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

20. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed Grounding System:

1. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.

2. Patch panels shall be bonded to racks using the appropriate bonding screws. Mounting rails may utilize cage nuts, threaded holes or thru hole mounting fasteners to secure patch panels to the rails.

3. Refer to electrical diagrams for additional ground connection requirements.

D. Miscellaneous Equipment:

1. Arrange all terminal blocks in a manner that allows natural wiring progression and minimizes crossing of wires.

2. Provide patch cords and cross connect cables as necessary for a complete operational telephone and data network system. Consult with owner to determine any special needs such as dedicated phone lines.

PART 4 – LABELING

4.1 GENERAL

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables

© BNA Consulting

origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

B. All telecommunications spaces, pathways, cables, connecting hardware, equipment, racks, patch panels, outlet/connectors, and grounding system shall be labeled in accordance with TIA/EIA 606-A.

C. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.

4.2 TELECOMMUNICATION PATHWAYS

A. Identify each dedicated pathway (including inner ducts) for the voice and data system.

B. Label pathways at regular intervals and wherever they are accessible.

4.3 TELECOMMUNICATION CABLES

A. Identify cables at each end with a permanent label or physical/electronic tag.

1. The same alphanumeric identifiers should be used at both ends of the cable.

2. Identify cables at regular intervals throughout and wherever they are accessible.

3. Cables shall be identified in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate that can be accessed by removing the cover plate and to the cable behind the patch panel on a section of cable that can be viewed without removing the bundle support ties. Cables labeled within the bundle where the label is obscured from view shall not be acceptable.

4.4 CONNECTING HARDWARE

A. Identify connecting hardware items (termination blocks, cross-connects, racks, cabinets, patch panels, telecommunications outlet/connectors, ports) using alphanumeric identification such as the following three-level scheme:

1. First level—Termination field or patch panel. Color-coding or other labeling should be used to uniquely identify each termination field (e.g., voice and data) on a common mechanical assembly.

2. Second level—Terminal block within a given field or patch panel that could be a row of insulation displacement connectors (IDCs), optical fiber connectors, or modular jacks.

3. Third level—Defines the individual position within a given terminal block or patch panel.

PART 5 - MISCELLANEOUS

5.1 TESTING:

A. General

1. Provide testing within 10 days of completion for all copper and fiber optic cable according to TIA/EIA standards and any other requirements of the manufacturer who will provide warranty.

2. Submit copy of current calibration of all testing equipment. Submit all test reports electronically to architect/engineer and include in O&M manuals to include test reports. Meter shall have been calibrated within the past 12 months.

3. Correct any malfunctions. Contractor shall re-terminate/replace any cable, connection, or equipment found to be defective or non-compliant with these specifications and referenced standards.

4. Invite Owner IT representative and Engineer to witness and/or review field testing. Notify five business days prior to commencing testing.

B. Copper Cable

1. Utilize Level IIIe, IV, V Tester to test all equipment and each outlet, horizontal cable, termination block, patch cords, etc. to verify compliance with requirements. Testing shall consist of industry accepted verification tests for the Category of cable installed and shall meet latest requirements of EIA/TIA cabling Standards.

2. UTP Cable and Links: All UTP cabling channel must be tested at swept frequencies up to 500MHz for internal channel performance parameters as defined in IEEE 802.3an and ANSI/TIA/EIA-568C. Certifications shall include the following parameters for each pair of each cable installed:

   a. Wire map (pin to pin connectivity)

   b. Length

   c. Insertion Loss

   d. Near End Crosstalk (NEXT)

   e. Attenuation to Crosstalk Ratio Far End (ACRF)

   f. Return Loss

   g. Propagation Delay

   h. Delay Skew

   i. DC Loop Resistance

   j. DC Resistance Unbalance

   k. Power Sum Near-End Crosstalk (PS-NEXT)

   l. Attenuation to Crosstalk Ratio Near-End (ACR-N)

   m. Power Sum Attenuation to Crosstalk Ratio Near-End (PS-ACR-N)

   n. Attenuation to Crosstalk Ratio Far-End (ACR-F)

   o. Power Sum Attenuation to Crosstalk Ratio Far-End (PS-ACR-F)

   p. Transverse Conversion Loss (TCL)

   q. Equal Level Transverse Conversion Transfer Loss (ELTCTL)

3. All channels that fail testing parameters will be replaced at the Contractor's expense until all channels pass the performance parameters.

C. Owner reserves the right to hire an independent testing company to spot check the test results. If the results vary more than 10% from the results provided by the Contractor, the Contractor will be required to prove his results are correct or retest the entire system.

5.2 WARRANTY:

A. Register installation with cable/connectivity manufacturer.

B. Provide and submit all test results to owner, engineer, and manufacturer and meet all other manufacturer requirements in order to provide minimum 20-year extended product link warranty for complete cabling/connectivity installation, including all copper and optical fiber utilized on the entire channel. The channel warranty shall be provided by the connectivity manufacturer. Include replacement material and installation for any defective product.

© BNA Consulting

5.3 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

5.4 TRAINING:

A. Provide four hours training on the operation and installation of the structured cabling system at job site, at no cost to owner.

5.5 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 1500

© BNA Consulting

SECTION 27 4100

AUDIOVISUAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.

C. Refer to specification 26 0553 for conduit and junction box color requirements.

D. Refer to specification 27 1500 for category and/or optical fiber cable and connectivity specifications.

E. All unshielded category 'UTP' and/or optical fiber cable, for AV equipment, used on this project shall match the horizontal cabling within the building.

1. Category cables used for transporting video, audio, and controls simultaneously from transmitters to receivers and/or switchers shall follow the Manufacturer's recommended cabling specifications.

1.2 ADMINISTRATIVE REQUIREMENTS:

A. BNA Project Contact:

1. Jaime Verhaal, CTS-D
   a. Phone: 801-532-2196
   b. Email: jverhaal@bnaconsulting.com
2. Sean Graham
   a. Phone: 801-532-2196
   b. Email: sgraham@bnaconsulting.com

B. Bid Submittal:

1. Equipment Costs: Breakout cost of material and labor as different line items. Refer to bid form for breakout cost requirements.
2. Side loudspeakers W1 are an alternate replacement. Include in your base bid the following:
   a. Testing the existing loudspeakers.
   b. Replace wiring and amplifier as indicated in the signal flow.

C. Coordination:

1. Coordinate final inspection of the systems installed, with Audiovisual (AV) Consultant, three (3) weeks in advance.
2. Obtain GANTT chart for construction time frame from the General Contractor.
3. Coordinate with Electrical contractor to meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate the mounting condition of all ceiling-mounted AV equipment with ceiling type. During second meeting, coordinate the location of all ceiling-mounted AV equipment in each area.
4. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all loudspeaker and duct work in all areas.
5. Meet with Electrical contractor prior to pathway rough-in to coordinate AV system requirements in each area.

© BNA Consulting

6. Meet at least once, priorscree to rough-in, with horizontal cabling installer to verify all AV network requirements. Coordinate cable color according to specification 26 0553.

7. Meet at least twice with owner and programmer to coordinate AV network requirements. Hold the first meeting after submittal of shop drawings to coordinate network protocols, including but not limited to: IP address schedules, MAC address schedules, patchbay schedules, security requirements, and VLANs. Hold the second meeting prior to AV system deployment.

8. Coordinate color and finish of all AV system components with Architect or Electrical contractor as appropriate.

9. Coordinate all AV system components within millwork/furniture with millwork shop drawings prior to rough-in.

10. Coordinate color (including custom color) and finish of all AV system components with Architect prior to ordering. Architect may require custom color of grills, face plates, etc. AV contractor shall paint or have devices painted by others. The cost for custom colors shall be within the AV Contractors Bid.

11. Notify AV Consultant when rough-in is complete and ready to inspect. AV Consultant and Electrical Engineer to sign off on rough-in prior to rough-in resuming rough-in for typical rooms.

D. Contractor is responsible for coordinating with all other trades for equipment locations, mounting requirements, supports and plenum space requirements.

E. AV contractor shall attend the electrical pre-construction meeting per specification 26 0500.

1.3 DESCRIPTION OF WORK:

A. Provide the specified systems in a complete and operating condition with all necessary materials and labor to fulfill the requirements and the intent of the drawings and specifications. Except as otherwise indicated, provide manufacturer's standard system components. Contractor shall furnish all cables, materials and equipment, whether specifically mentioned herein or not, to ensure a complete and functional system.

B. Master quotes do not relieve contractor from preforming due diligence for equipment type, equipment quantity, and quantity of room types. Any errors, conflicts, or omissions between the drawings and/or specifications and master quotes shall be the responsibility of the contractor to resolve.

C. Bidders wishing to provide equipment other than the equipment specified shall submit proposed substitute equipment to AV Consultant eight (8) working days prior to bidding. Submittals for prior approval shall include description of equipment, design intent, complete riser diagrams for proposed equipment, equipment specifications, cut sheets of proposed equipment, reason for alternate equipment. AV Consultant may request physical equipment to test and demo. Acceptance of proposed equipment by AV Consultant shall not relieve AV contractor from responsibility to provide audio-visual systems equal to those specified in this Section. Contractor shall be ultimately responsible for providing complete and working audio-visual systems that function, control, and operate in the same manner as the specified equipment. AV Consultant has final say if proposed equipment is equal to the specified equipment. Equipment that AV Consultant is not familiar with will require the contractor to provide manufacturer training at manufacturer's facility and have a manufacturer representative present at time of commissioning.

1. Refer to section 2.2 for approved equals of basis of design equipment.

D. Equipment submitted in the bid proposal that has not been approved by AV Consultant in writing will not be accepted and shall be replaced by approved equipment at contractor's expense. Equipment not listed within this specification, or contract documents, that is required for a complete and working system, shall be of professional grade and used in the same manner as needed for a complete and working system.

© BNA Consulting

E. Input plates shall match the color and style being used throughout the project.

F. All control processors and controllers are to be on an unswitched power connection and connected to an uninterrupted power supply if indicated within the design.

1.4 DEFINITION OF TERMS:

A. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's applications and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

B. Configure: The term "Configures" or “Configuration” is used to describe set up of components which includes menu based settings, image alignment, dip switches, setup wizards, EDID, etc. required for standard functionality.

C. Contractor: the term “Contractor” refers to the company contracted to perform the work within this specification and associated documents.

D. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

E. Furnish, Install, and Provide: Refer to 26 0500 for definition.

F. General: Basic Contract definitions are included in the General Conditions.

G. Graphical User Interface (GUI): The term “Graphical User Interface (GUI)” is used to describe the user interface from a touch screen. This is a custom interface provided with the programming of the system.

H. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

I. Installer: An "Installer" is the Contractor, or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

J. Programming: The term “Programming” is used to describe writing computer code or a sequence of logic to perform an operation from a triggering event. Programming will be installed on a control processor or similar platform identified within the documents.

K. Programmer: the term “Programmer” is the company or entity engaged by the programming company, either as an employee, subcontractor, or sub-subcontractor, for providing the programming services.

L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

M. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions."

1.5 QUALITY ASSURANCE:

A. Installer:

1. Integrating firm shall have worked satisfactorily for a minimum of five (5) years of completing systems equal to this scope, quality, type and complexity.

© BNA Consulting

2. Key personnel assigned to the project shall each have minimum of ten (10) years of experience in completing systems equal to this scope, quality, type and complexity.
3. Contractor shall be a factory authorized distributor of all equipment specified for the geographical area of the project.
4. Contractor shall maintain complete installation and service facilities for the duration of the project contract.
5. Contractor shall have current manufacturer certificates for all AV systems and equipment listed within this specification.
6. Contractor shall be in good standing with the owner.
7. Contractors that do not meet the above requirements cannot bid on this project.

B. Contractor must follow the standards described within:

1. BICSI/AVIXA AV Design Reference manual.
2. ANSI/AVIXA 2M-2010 Standard guide for Audiovisual Systems Design and Coordination Processes.
3. ANSI/AVIXA 10:2013 Audiovisual Systems Performance Verification Guide.

C. All work shall be done by expert technicians qualified in the field with knowledge of specified systems. Workmanship shall comply with industry best practices concerning grounding, shielding, cable dressing, cable termination and equipment mounting.

D. PRE-APPROVED INSTALLERS:

1. AVI-SPL
2. Cache Valley Electric
3. Ford AV
4. Marshall Industries
5. Performance Audio
6. Poll Sound
7. WEBB AV
8. Bids submitted by non-approved installers will not be accepted.
9. Bidders not pre-approved shall submit in writing the following for review at least eight (8) working days prior to bid:
    a. List of qualifications including:
        i. Industries certifications including manufacturers.
        ii. Approved resale manufacturers.
    b. Past and current projects within the last five (5) years similar in scope and size.
    c. Three (3) Different referrals from the owners of three (3) different projects within the last five (5) years.

1.6 SUBMITTALS: Refer to specification 26 0502 for shop drawing submittal requirements.

1.7 WARRANTY:

A. Systems shall be guaranteed for a period of one (1) year from the date of substantial completion against defective materials, inferior workmanship or improper installation adjustment. Guarantee shall cover all parts and labor, etc. required to maintain the functionality at the time of system completion.

1. System completion shall be signed off by the programmer, contractor, and the owner. At that time the system will be considered complete.

© BNA Consulting

2. The contractor shall utilize their existing service department for warranty calls. Trouble shooting of system components shall be performed before adjustment to the programing is required.

B. If system failure causes audiovisual system to be inoperative or unusable for its intended purpose, contractor, when notified of the problem, shall repair the system to be operational and usable within three (3) business days. If defective components cannot be repaired in time, provide temporary equipment as required.

C. Programming warranty includes the following:

1. GUI: limited to button rearrangement.

D. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above.

PART 2 – PRODUCTS

2.1 GENERAL:

A. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications or the drawings shall be submitted in writing to the AV Consultant for clarification.

B. Equipment lists are provided to identify quality and functional expectations. They may not be complete. Coordinate with devices shown on drawings, system risers and equipment lists for system intent. Provide a complete and functional system as described within the construction documents.

2.2 MANUFACTURER APPROVED EQUALS:

A. The Manufacturers listed below have the potential to be considered equals, as it relates to the system design intent and the equipment specified herein. Refer to section 1.3.C. for substitution requirements. Any equipment chosen as equal to what has been specified in section 2.4 will be the responsibilities of the AV Integrator to coordinate all resulting changes and guarantee a complete and functional system e.g. rough-in requirements, programming, etc. Please note that some components have been chosen over others for features and/or size limitations. Equipment listed below with an asterisk have feature and/or size limitations and may not be substituted.

1. Amplifiers – Ashly, Crestron, Crown, Extron, Lab Gruppen, Powersoft, QSC and StewartAudio
2. Assisted Listening Systems – Listen Technologies, Williams AV
3. Cables – Belden, Crestron, Extron, Gepco/General, Ice, Kramer, Liberty, and Westpenn cables
4. Controls – AMX, Crestron and Extron
5. Displays – LG, NEC, Planar, Panasonic, Samsung, Sharp, and Sony
6. DSPs – Biamp, BSS, Extron, QSC and Symetrix
7. Equipment racks – AtlasIED, Chief, Lowell and Middle Atlantic
8. Loudspeakers – AtlasIED, Bose, Community, JBL and SoundTube
9. Mounts – Chief and Premier mounts
10. Network equipment – Cisco, Luxell, and Netgear
11. Networked Audio – Attero tech (QSC), Extron, and RDL
12. Projection Screens – Da-Lite, Draper and Stewart Filmscreen
13. Video Equipment – AMX, Crestron, and Extron

© BNA Consulting

14. Wall plates – Attero tech (QSC), Crestron, Extron, RCI Custom, Liberty Panelcrafters and RDL

2.3 GENERAL EQUIPMENT REQUIREMENTS:

A. The equipment specified in this document aims to fulfill the intended functional requirements by precisely identifying the necessary equipment. Depending on the timing of component orders and the project timeline, there may be instances where certain equipment needs to be replaced with newer models. In the event that the indicated equipment is unavailable or has been replaced, the supplier or contractor shall provide a new model that offers comparable functionality.

B. Loudspeakers:

1. Provide applicable mounting equipment as needed, including but not limited to; back boxes, mounting hardware, safety equipment, and seismic restraints.

C. Video Signal:

1. The equipment listed below is considered to be equal replacement parts for a point-to-point video solution as it relates to the system design intent. Equipment listed in section 2.4 override the equipment listed below.

a. Cable Equalizer for cable lengths exceeding 30’ but no more than 75’ or that have more than two (2) union connections. Connect to external power supply and do not use the 5 volts within the HDMI cable.

i. Extron – HD 4K 101 Plus or Kramer – PT-3H2

b. Point to point HDBaseT extension, 18 Gbps, 4k60 4:4:4 at 100 Meters:

i. Crestron – DM-TX-4KZ-100-C-1G with DM-RMC-4KZ-100-C. or Extron – DTP2 T 211 with DTP2 R 211.

c. HDMI cables intended for client device connection and that are less than 15’ shall be a flexible cable and support 18 Gbps, 4k60 4:4:4 for the entire length of the cable.

d. Equipment that is not preapproved by the AV Consultant in writing will not be accepted and will be replaced with the approved equipment at no cost to the Owner.

D. Audio Signal:

1. The equipment listed below is considered to be equal replacement parts for a point-to-point video solution as it relates to the system design intent. Equipment listed in section 2.4 override the equipment listed below.

a. Passive or Active audio summing adapter. Extron – ASA 131 or RDL – STA-1

b. Isolation transformer: RDL – EZ-HK1

E. Cables grouped together shall be dressed in expandable nylon loom, similar to Techflex - Flexo

F. Equipment Racks:

1. All AV equipment racks within this specification shall have the following accessories and/or features, either rack mountable or built into the rack, depending on the model of the rack. Refer to bid documents for all rack mounted equipment. Provide the following accessories as referred to in elevations. RUs are indicated in the elevations and noted with a # symbol in the part number.

2. General Equipment

a. Shelving: Middle Atlantic – SS; 1RU shelf.

© BNA Consulting

b. Drawers:
   i. Nonlocking: Middle Atlantic – D#
   ii. Locking: Middle Atlantic – D#LK
c. Header panel, located at the top of the rack, AV contractor to submit their logo to RCI for inclusion in the Header panel. If AV contractor has another company that makes the Header panel, provide that information to the AV Consultant.
   i. RCI Custom – BNA001-200120MM-01
d. Blank plates: Middle Atlantic – EB#
e. Surge protection for all devices located within the rack. Surge protector shall be: 20 AMPs, rack mountable or mount to a side rail and at least 1,000 joules of protection.
   i. Recommended Surge protector is Middle Atlantic – PD-920R-SP. Additional acceptable manufacturers are: Furman, Juice Goose, Tripplite and SurgeX.
f. Horizontal, vertical, and entry cable management.
   i. All cabling shall be straight off of the back of equipment to horizontal supports connected to equipment rack. Cabling shall follow support to vertical supports when going into other components and/or out of the equipment rack.
   ii. Cabling secured to other cabling and supported from the connector is not acceptable.
   iii. Separate AC power and other signal types from each other.
g. Provide 20 Amp rated power strips as necessary.
h. Sequencers
   i. Provide a Middle Atlantic – PDS-620R or Furman – CN-2400S Sequencer.
   ii. All equipment racks with the following equipment shall have a sequencer within the equipment rack. AV integrator to follow industry standards when using sequencers.
      1. Amplifiers
      2. Video processors without control processors
i. Active Thermal Management
   i. Solid rear door.
   ii. Fan kit totaling 190 CFM mounted on the top face of the equipment rack.
      1. Thermostatic fan controller (set temperature range between 80 degrees and 90 degrees Fahrenheit.
      2. Fan guards
      3. Recommend equipment are Middle Atlantic – QBP-2 Blower panel or Middle Atlantic – CAB-COOL50 Cabinet Cooler.
   iii. Blank panels on the front of the equipment rack in all unused rack spaces.
   iv. Solid blank panels in unused rack spaces in top six (6) racks spaces.
   v. Stack power amplifiers with 1 open rack space between.

© BNA Consulting

vi. Provide active thermal management in the following equipment racks in the following systems.

1. Auditorium Racks ‘R2’ and ‘R3’

2.4 EQUIPMENT REQUIRED PER ROOM TYPE

AV SYSTEMS PROGRAMMING			
TYPE	**DESCRIPTION**	**MANFR.**	**MODEL NO.**
	AV SYSTEMS PROGRAMMING ALLOWANCE REFER TO SECTION 3.3 FOR SCOPE OF PROGRAMMING	BNA CONSULTING	$6,100.00 SYSTEMS PROGRAMMING ALLOWANCE
END OF SCHEDULE			

AUDITORIUM EQUIPMENT SCHEDULE (1 OF 3)			
TYPE	**DESCRIPTION**	**MANFR.**	**MODEL NO.**
R3, R1	EQUIPMENT RACK, STAND ALONE	EXISTING	EXISTING
ER1	EQUIPMENT RACK, STAND ALONE 84" TALL, 32" DEEP, 45 RU WITH VENTED FRONT DOOR	MIDDLE ATLANTIC	BGR-4532-AV
R2	EQUIPMENT RACK, SKELETON 16" DEEP, 12 RU	LOWELL	LCR-1216
	DRAWER, PULL OUT, RACK MOUNT LATCHING, 2 RU	MIDDLE ATLANTIC	D2
RCO	RELAY CONTROLLED OUTLET (PROVIDE APPROPIRATE MODEL PER AMPERAGE AND CORDED/HARD WIRED RQUIRMENTS FOR EACH AMPLIFIER SHOWN)	MIDDLE ATLANTIC	RLM-20-1CA RLM30-L530-1 RLM30-L520-1 (PROVIDE APPROPIRATE MODEL PER AMPERAGE AND CORDED/HARD WIRED RQUIRMENTS FOR EACH AMPLIFIER SHOWN)
	SMART SEQUENCING POWER CONDITIONER, 20A, 9 OUTLETS	FURMAN	CN-2400S
M1	MICROPHONE INPUT, WALL PLATE WITH TRANSFORMER	RDL	D-J1
M2	DUAL MICROPHONE INPUT, WALL PLATE WITH SOLDER CONNECTIONS	RDL	D-XLR2F
TxH	HDMI INPUT, WALL PLATE WITH DTP TRANSMITTER	EXTRON	DTP2 T 201 D
Rx	HDBT RECEIVER, OUTPUTS: 1-HDMI, 1-L/R AUDIO, 1-COM, 1-IR, INPUTS: 1-HDBT IN, REMOTE PWR	EXTRON	DTP2 R 211
V	VOLUME CONTROL, 70V, DECORA WATTAGE TO EXCEED LINE LOAD BY 20%	ATLAS	ATXXXD
	MICROPHONE SPLITTER (JENSEN TRANSFORMERS)	WHIRLWIND	SPC82JT

© BNA Consulting

ALS	ASSISTED LISTENING PRIME LEVEL III STATIONARY RF SYSTEM- 72 MHZ INCLUDING: TRANSMITTER ANTENNA KIT RACK MOUNTING KIT (4) RECEIVERS (4) EAR SPEAKERS (2) NECK LOOP LANYARDS 2M DUAL RCA CABLE 12-UNIT CHARGING TRAY NOTIFICATION SIGNAGE KIT	LISTEN TECHNOLOGIES	LS-55-072 INCLUDING: (1) LT-800-072-01 (1) LA-122 (1) LA-326 (4) LA-4200-072 (4) LA-401 (2) LA-430 (1) LPT-A107-B (1) LA-381-01 (1) LA-304
	NETWORK SWITCH, MANAGED, (24) PoE+ 370W (24) 1GB CAT, (2) 1GB RJ45 UPLINK	LUXUL	XMS-2624P

END OF SCHEDULE

AUDITORIUM EQUIPMENT SCHEDULE (2 OF 3)

TYPE	DESCRIPTION	MANFR.	MODEL NO.
TP7	TOUCH PANEL, 7" DIAGONAL	EXTRON	TLP PRO 725M BB 710M (BACK BOX)
TPT	TOUCH PANEL, 7" DIAGONAL (COLOR BY ARCHITECT)	EXTRON	TLP Pro 725T
	PRESENTATION SWITCHER, 4K60 4:4:4, 8-IN, INPUTS: 6-HDMI, 2-HDBaseT, 4-LINE AUDIO, 2-MIC, OUTPUTS: HDBaseT W/HDMI MIRRORED, CONTROL: 3-COM, 2-IR, 4-IO, 4-RELAY, DIGITAL BUS, 4-LAN, AMP: 2 CH, 25 W @8Ω, <0.1 THD	EXTRON	IN1808 IPCP Q SA
	UNIFIED CORE WITH 24 LOCAL AUDIO I/O CHANNELS, 128X128 TOTAL NETWORK I/O CHANNELS WITH 8X8 SOFTWARE-BASED DANTE LICENSE INCLUDED, USB AV BRIDGING, DUAL LAN PORTS, POTS AND VOIP TELEPHONY, NO GPIO, 16 NEXT-GENERATION AEC PROCESSORS, 1RU.	QSC	CORE 110F-V2
	NETWORKED I/O EXPANDER 4 MIC/LINE INPUTS	QSC	QIO-ML4I
	MIXING CONSOLE, 40 X 25 25 FADERS, 32 MIC PREAMPS 1 EXPANSION CARD SLOTS	BEHRINGER	X32 (INCLUDE LIGHT)
	EXPANSION CARD, DANTE	BEHRINGER	X-DANTE
	16 XLR INPUT / 8 XLR OUTPUT - 96KHZ, AES50, EXPANDER STAGE BOX	BEHRINGER	SD16
	TWO CHANNEL, 2.4GHZ BASE STATION WITH TWO ANTENNAS, 7KHZ WIDEBAND AUDIO	CLEAR-COM	BS410
	TWO CHANNEL, 2.4GHZ BELTPACK, 7KHZ WIDEBAND AUDIO	CLEAR-COM	BP-410 PROVIDE QTY (4)
	LITHIUM-ION RECHARGEABLE BATTERY	CLEAR-COM	BAT50 PROVIDE QTY (8)
	4-WAY BATTERY CHARGER	CLEAR-COM	AC50
	INTERCOM HEADSET	CLEAR-COM	CC-300 PROVIDE QTY (8)

© BNA Consulting

1C, 1D, 1E	POWER AMPLIFIER 4 CHANNEL X 350 WATTS, 4 Ohms - 70/100V	LEA PROFESSIONAL	CONNECT 354
1A	AMPLIFIER, CLASS-D, 4 CH, 1,500 W @ 8Ω/CH, 20,000 W MAX OUTPUT, FR; 5 Hz - 20 KHz, <0.05 THD, 4-XLR IN, 4-XLR OUT, 1-AES3, LAN,	DANLEY	DNA 20K4
1B	AMPLIFIER, CLASS-D, 4 CH, 500 W @ 4Ω/CH, 2,000 W MAX OUTPU, FR; 20 Hz - 20 KHz, <0.05 THD, 4-EURO, 4-RCA IN, 1-DIGITAL IN/OUT, LAN,	DANLEY	DSA 500X4
C6	LOUDSPEAKER, 6", CEILING TWO-WAY, 120 DEGREE COVERAGE	JBL	CONTROL 47C/T
W1	LOUDSPEAKER, 8", SURFACE MOUNT 100 DEGREE COVERAGE	JBL	CONTROL 29AV
W2	"LOUDSPEAKER, 5"", SURFACE MOUNT 100 DEGREE COVERAGE"	JBL	CONTROL 25AV
A8	LOUDSPEAKER, CABINET, 90° X 60°, 105 dB, 133 dB MAX, 45 Hz - 13.5 KHz ±3dB, 8Ω, DRIVERS: 4x15" LF, 6x4" MF, 1.4" HF, PWR RATING: 2,800 LF - 800 MHF WATTS	DANLEY	SH96HO MOUNTING BRACKETS AS REQUIRED: BRKT-96BB, BRKT-95
END OF SCHEDULE			

AUDITORIUM EQUIPMENT SCHEDULE (3 OF 3)

TYPE	DESCRIPTION	MANFR.	MODEL NO.
A7	LOUDSPEAKER, CABINET, 95° X 55°, 104 dB, 129 dB MAX, 350 Hz - 17.4 KHz ±4dB, 4Ω, DRIVERS: 2x8" LF, 1.4" HF, PWR RATING: 600 WATTS	DANLEY	SH95HO MOUNTING BRACKETS AS REQUIRED: BRKT-96DF
A6	LOUDSPEAKER, CABINET, 90° X 60°, 98 dB, 124 dB MAX, 55 Hz - 24 KHz ±4dB, 4Ω, DRIVERS: 2x8" LF, 1x5" MHF COAXIAL, PWR RATING: 800 LMHF WATTS	DANLEY	SM96
A9	LOUDSPEAKER, SUBWOOFER, 60° X 60°, 108 dB, 134 dB MAX, 35 Hz - 270 Hz ±4dB, 4Ω, DRIVERS: 1x18" LF, PWR RATING: 1,700 WATTS	DANLEY	TH118XL
P1	LCD, 16,000 lm, WUXGA w/ENHANCED 4K, LASER, 1-DVI-D, 1-HDMI, 1-HDBaseT, 1-VGA, 3-USB, 1-COM, 1-LAN, 1-AUDIO OUT, 60° V / 30° H LENS SHIFT	PANASONIC	OFCI
SC1	CEILING, MOTORIZED, 16x10, 335" (177.5"X 284") SCREEN W/MATTE WHITE MATERIAL, AV CONTROL SYSTEM INTEGRATION	DA-LITE	PROFESSIONAL ELECTROL W/ LOW RS232 CONTROLLER
END OF SCHEDULE			

PART 3 – EXECUTION

3.1 INSTALLATION OF AV SYSTEMS:

A. Provide AV systems and ancillary equipment as indicated on drawings and in accordance with equipment manufacturer's written instructions, the NEC, and with industry best practices.

© BNA Consulting

B. Coordinate all work performed by other contractors pertaining to the AV system, including raceways, electrical boxes and fittings.

C. Video systems.

1. HDCP:

a. All equipment within the signal path must be capable of processing HDCP-compliant material.

b. All switcher, scalers, transmitters, and receivers shall reflect the HDCP compliance of the endpoint/display(s).

c. HDCP shall be disabled in the switcher/scaler when a non-HDCP-compliant endpoint/display is used.

2. EDID Strategy:

a. Permanent video sources shall be set manually within the equipment to output their native resolution. Video properties shall not rely on EDID.

b. Portable video sources and wall plates shall use EDID tables within the switcher/scaler for preferred video properties. The EDID table shall be set with the following settings:

i. Most common resolutions within the display's aspect ratio.

1. 3840 x 2160 (UHD) 60Hz, 4:4:4 Chroma sample

ii. 1280 x 800 (WXGA), 60Hz, and RGB Color Space

iii. Audio: refer to control section for audio requirements. This will include mono, Stereo, Surround sound, etc.. All audio will be 44,100 Hz, 16 bit unless otherwise noted.

D. Pathway Requirements:

1. General:

a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.

b. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. Field coordinate alternate pathway requirements with other trades onsite. New pathways shall not exceed distance limitations defined within this specification. Notify the Engineer of the changes for final approval prior to proceeding with the change.

2. Conduits:

a. Contractor shall provide a minimum of 1-1" EMT conduit from device to accessible ceiling space unless otherwise noted. Then utilize non-continuous cable support from devices to connecting device. Refer to AV symbol schedule for specific conduit requirements.

i. Provide non-continuous open top cable supports every 5' above accessible ceiling.

b. Provide conduit from device to device in open and/or exposed ceilings. Ceilings with clouds are considered open/exposed ceiling.

c. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.

© BNA Consulting

d. Provide large radius elbows on all bends.

e. Conduit runs shall not have continuous sections longer than 100 feet without a pull box. Refer to rough-in schedule for conduit fill capacity.

f. AV conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.

g. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.

h. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.

3. Open Top Cable Support Requirements:

a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables

b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

4. Pull Box Requirements:

a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.

b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90 degree bends, or contain a reverse bend.

c. Conduits that enter a pull box from opposite ends should be aligned.

d. Pull boxes shall have a length 12 times the diameter of the largest conduit.

e. All pull boxes must be accessible.

E. Cabling System:

1. Follow T568B scheme for copper category cabling terminations.

2. Provide a minimum 6" service loop in each AV system junction box. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.

3. In a false ceiling environment, a minimum of 3 inches shall be maintained between cable supports and false ceiling. At no point shall cable(s) rest on lay-in ceiling grids or panels.

4. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

5. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for AV cable is required, the contractor shall install appropriate carriers to support the cabling.

6. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

7. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.

8. Pair untwist at the termination shall not exceed 0.125". The cable jacket shall be maintained as close as possible to the termination point.

© BNA Consulting

9. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

10. Group multiple cabling together with expandable nylon loom, similar to Techflex - Flexo, when cabling exists a cavity and connects to a device. Cabling within a lectern, podium or millwork shall have expandable nylon loom sleeve as well.

F. Grounding System:

1. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.

2. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.

3. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.

4. All active equipment shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.

5. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.

6. Refer to electrical diagrams for additional ground connection requirements.

G. Cabling groups and conduit separation:

1. Refer to “CABLING GROUPS AND CONDUIT SEPARATION SCHEDULE”, located on the drawings

H. Firmly secure all equipment in place that is not intended for portability.

I. Mount projectors permanently and provide mechanical index ensuring precise alignment of the projected image.

J. Provide adequate structural support for AV system components. Provide fastenings and supports with a safety load factor of at least five.

3.2 LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and wall plates. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

B. All AV pathways, cables, connecting hardware, equipment, racks, patch panels, outlet/connectors, and grounding system shall be labeled in accordance with TIA/EIA 606-A.

C. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Labels shall be uniform in physical size and text height with minimal blank space. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.

© BNA Consulting

D. Provide laminated plans (minimum size 11x17) of all AV as-built plans (including one-line diagrams) in each and every AV Rack.

E. Label each equipment with the date (month/year) that it was installed along with the IP address, if applicable, and equipment type.

3.3 CONTROL SYSTEM FUNCTIONALITY:

A. GENERAL:

1. The control processing and digital signal processing programming required for AV sub-systems as defined in section 2.4 of this specification shall be completed by BNA Consulting.
    a. The General AV sub-systems require configuration and are not included in BNA's programming scope of work.
    b. Configuring of system components will be part of the Contractors scope of work. Contractor shall provide IP address, MAC address, Serial numbers, etc to BNA for coordination with the program.
    c. IP address will be coordinated by the programmer and shared with contractor for implementation into specific devices.
    d. If the contractor chooses to provide their own programming services, it must match the functional intent as defined by BNA Consulting exactly. No exceptions.
2. The successful bidder for this specification section (27 4100) shall contract BNA Consulting for performance AV programming services.
    a. The allowance defined in section 2.4 for the performance AV systems programming services shall be included in the bid as a line item.
    b. Contracting shall take place once shop drawings are submitted. The Programming phase shall begin upon final approval of AV contractor shop drawings.
3. Control programs & DSP configuration programs shall be designed to match the schematic system wiring as shown in approved shop drawings.
4. The AV contractor must field wire each system in accordance with the final approved shop drawings.
    a. Any deviations made to shop approved shop drawings will be subject to additional programming service fees.
5. Before programming services commence, the AV contractor shall confirm that all connections are complete, and all equipment is powered up and functional.
    a. Written documentation including site progress photos shall be provided to BNA Consulting prior to commencement of the programming phase.

B. CONTRACTOR SCOPE OF WORK:

1. Configuration:
    a. The following is expected to be complete prior to implementation of the program. Testing of the system settings shall be confirmed by the installer.
    b. Component Configuration requirements:
        i. Setup wizard is complete and ready for functionality.
        ii. Image set to Dot to Dot and aligned with the screen surface.
        iii. Device controls are set as identified in the signal flows ie: RS-232, IR, Relay, Contact, or IP controls.

© BNA Consulting

iv. Limit settings on screens, shades, etc..

v. Turning off ECO mode.

vi. Dip switches, dials, and manual settings on devices.

vii. Device network settings, IP Static/DHCP, Domain, Subnet, etc.

1. These will be provided by the programmer for the AV installer to configure prior to implementation of the program.

2. Network connection and power for devices are expected to be ready for testing.

viii. Configuration of the Controller processor/controlling device will be by the AV programmer in the AV installers local facility.

c. Coordinate with the programmer on programming testing prior to installation.

C. PROGRAMMER SCOPE OF WORK:

1. Configuration:

a. Network switch

b. Control Processor and devices with a fully functional controller

c. DSP

d. Touch panel / keypad

D. Amplifiers shall be set to go to stand by after 30 minutes of no audio detection.

3.4 CYBER SECURITY

A. Contractor shall change all default username and passwords for all network devices provided. A Strong Password should include at a minimum the following:

1. Be at least 12 characters in length

2. Contain both upper and lowercase alphabetic characters (e.g. A-Z, a-z)

3. Have at least one numerical character (e.g. 0-9)

4. Have at least one special character (e.g. ~!@#$%^&*()_-+=)

5. Cannot contain full words

B. No written username or passwords shall be located in any areas of installation.

C. Network devices to be set up on a separate network other than owner's LAN ensuring no internal or external users can access system without authorization.

D. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

3.5 FIELD QUALITY CONTROL:

A. TESTING:

1. Refer to "INTEGRATOR VERIFICATION CHECKLIST" at the end of this section, for system verification requirements. Verification checklist shall be complete prior to final commissioning.

2. Upon completion of installation of each system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units on site, then retest to demonstrate

© BNA Consulting

compliance; otherwise, remove and replace with new units, and proceed with testing.

3. Before inspection by owner and AV Consultant, and after completion of the installation, conduct system tests and make necessary corrections for proper system operation.

4. Adjust, balance and align equipment for optimum quality and to meet the manufacturer's published specifications.

5. All limiters and/or compressors shall be set to prevent operators from over-adjusting sound levels and damaging system components, while maintaining the highest amount of gain possible.

6. System shall have no audible hum, noise, RFI, or distortion when operating under normal conditions. System shall reproduce material at the loudspeakers rated output level without audible distortion. All input levels shall be pre-set so system may be operated without causing unstable feedback under normal use.

7. System shall have no image distortion, hum bars, color shift, or any other picture distortion while operating under normal conditions. Provide cable equalizers or an HDBaseT video solution. Cable equalizer shall be located near display and powered, on all cables that are more than 30 feet in length or with more than four (4) connection points. Refer to section 2.3.B in this specification for a list of pre-approved equipment. Adjust gain controls for optimum signal-to-noise with 0 dBu at a line-level input.

8. Perform polarity checks of loudspeaker lines by means of a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color coding.

9. Loose parts and poor workmanship or soldering shall be replaced.

10. Sweep Loudspeaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to Loudspeakers or enclosures. Notify owner of external causes of buzzes or rattles.

11. Equalize the loudspeakers to produce less than 6 dB total variation between 500 Hz and 8000 Hz (+/- 3 dB).

12. Contractor shall provide system testing as described herein using up-to-date and industry accepted test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1. AV Contractor shall own and have access to a handheld Quantum Data 780C tester to allow for on-site verification testing and troubleshooting of HDMI and digital video networks and analog video displays. All test equipment used shall be factory calibrated within one year of use with references set daily prior to testing.

13. Contractor shall provide HDCP compliant device with digital cables, and digital HDCP content for testing of routing and HDCP compliant distribution and switching. Also provide analog VGA output equipment for testing of video switching, scaling, and distribution if analog is included with this project.

14. Horizontal cabling contractor shall test all twisted pair cabling used within the AV system following the standards in specification 27 1500 under the testing section. Provide documentation of testing to AV Consultant prior to final walk through.

B. At the time of final commissioning, if the AV consultant determines that the systems are not sufficiently complete to do a final punch list, and was not notified at least three (3) days prior to the visit, then a return visit will be required. The AV Consultant's return visit will be paid for in advance by the AV integrator at a flat rate of $1,200 per person, at no cost to the owner.

© BNA Consulting

3.6 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

3.7 TRAINING:

A. Provide four (4) sessions of two (2) hours each of training on the operation of each system, at job site, at no cost to owner. Systems shall be complete and have been finalized by the AV Consultant prior to training.

B. Training shall be recorded using a video recording device that support a minimum resolution of 1080P/60 with an integrated microphone connection for an external microphone and a camera tri-pod mount. Presenter shall be wearing a lapel microphone that connects to the recording device and a Tri-pod shall be used for stabilizing the recording device. Recordings that are shaky, poor audio and/or video quality, incomplete, or other issues will not be accepted and the contractor will be responsible for providing a new recording and training within five (5) business days of notification. Provide a digital copy, in MP4 format, on a USB flash drive to the Owner and AV Consultant. Also locate a USB flash drive with the training videos, programing, etc. in the as-built drawer of the main equipment rack. Digital copies sent as a link are not acceptable. identify within the Operating and Maintenance manuals, in the first section, where the flash drive is stored. Clearly label the flash drive as training videos. The second training shall take place within a month of the first training and all questions shall be answered.

C. Contractor shall be present at the first performance using the system within rooms listed below. Owner will coordinate with contractor 3 weeks in advance for personal trained on the system to help with the show and be onsite in case there are any problems. AV Contractor to provide this within his bid.

1. Auditorium

3.8 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 4100

© BNA Consulting

BLANK PAGE

© BNA Consulting

Project Title		Date	
City, State		Integrator	
Room/Area			

Audio/Video Signal Processors/Switchers					
Location	Rack #	Manufacturer & Model #	Serial #	Total Channels (In, Out)	Unused Channels (In, Out)

Power Amplifiers						
Location	Rack #	Amp #	Manufacturer & Model #	Serial #	Total Channels	Watts/Channel

Loudspeakers Zones							
Location	Rack #	Amp #	Amp Chan	Manufacturer & Model #	Serial #	Calculated Impedance	Measured Impedance

Wireless Microphone Receivers					
Location	Rack #	Manufacturer & Model #	Serial #	Usable Frequency Range	Chosen Frequency

© BNA Consulting

Portable & Miscellaneous Equipment			
Description	Location	Quantity	Manufacturer & Model #.

Sign below to confirm you have received portable & miscellaneous equipment listed above.

Owner Signature: _____
Date:_____

Title:_____

Personal Delivering Equipment: _____

© BNA Consulting

Audio Performance

Title	Description	Initial	Notes
Audio Signal Distribution	Verify that audio signal is being transported and distributed according to project documentation.		
Phantom Power	Verify that the correct phantom power is provided at the correct locations according to project documentation.		
Gain Before Feedback	Verify that the audio system is capable of reproducing speech above nominal operating levels without audible distortion or feedback.		
Rough Balance (input)	Verify that all inputs have the same nominal level.		
Gain Structure	Verify that proper gain structure has been followed from each input to output		
Rough EQ	In systems with equalization capability, equalize the loudspeakers to produce less than 6 dB total variation between 500 Hz and 8000 Hz (+/- 3 dB).		
DSP Programming	Verify that DSP systems have been programmed to allow signal routing, balance, and EQ. DSP programming should be saved in editable form prior to final commissioning visit.		
Rough Balance (output)	Verify that loudspeaker zones reproduce program content at the same level (+/- 1 dB).		
Emergency Muting	Verify that any required muting or operational changes are in accordance with location regulations in the event of a life safety or similar emergency.		
Assistive Listening	Verify that the assistive listening system functions as a complete personal listening system at specified levels without distortion or excessive background noise.		
Loudspeakers	Verify that there is no hum, noise, RFI, or distortion when operating under normal conditions.		
Loudspeakers	Verify that there are no rattles or buzzes with a high-level sign wave or 1/3 octave pink noise.		
Loudspeaker Zoning	Verify that loudspeaker zones are assigned correctly according to project drawings and specifications.		
Loudspeaker Impedance	Verify that all loudspeaker circuits have correct impedance as defined in the project drawings and specifications. Note measured impedance on previous page.		

© BNA Consulting

Loudspeaker Alignment	Verify that loudspeakers are mounted and aligned as shown in project documentation.		
Loudspeaker Polarity	Verify that all loudspeakers in a given space are wired with the same polarity.		
Loudspeaker Tap Settings	Verify the tap settings on all constant voltage loudspeakers.		
Loudspeaker Delays	Verify that loudspeakers are set with the proper delay. Refer to drawings and specifications for requirements		

General Items

Title	Description	Initial	Notes
Labeling	Verify that all cabling, equipment, and wall plates are labeled per specifications and as noted on drawings		
Cable management	Verify that proper cable management has been provided and that everything looks well-ordered.		
Power	Verify that power supplies are secured and in an accessible area.		
Sequencer	Verify that the sequencer(s) are setup correctly for industry standard power on/off function.		
Cyber Security	Verify that all default passwords have been changed. Provide all login information to the owner representative		
System testing	Verify that all systems have been tested and are in working order.		
System Certification	Verify system has been tested with industry standard testing equipment including the use of Quantum Data 780C		
Cabling	Verify that all cabling on the project meets the document requirements.		
Network	Verify that the owner has all of the needed information for all devices on the network. Provide this information to the owner via a spread sheet.		
Network	Verify that all IP address are within the owner's network scheme.		
Network	Verify that VLANS are setup as indicated in drawings and within owner's network infrastructure		
System One-lines	Verify that each equipment rack contains a set of one-lines diagrams for system installed. Refer to specifications for one-line requirements.		
Thermal Management	Verify active thermal management is setup correctly and working properly.		
Training	Verify training has been scheduled with the owner representative.		

© BNA Consulting

Control System Performance

Title	Description	Initial	Notes
Functionality	Verify that the control system functions according to project documents.		
Automatic controls	Verify that the automatic features work ie: room combining, video detection, etc..		
Lighting controls	Verify that the lighting system presents are correctly recalled by the control system as indicated in project documents.		
Shade controls	Verify that the shade controls are correctly recalled by the control system as indicated in project documents.		
Sequencer	Verify the sequencer is controlled as noted in project documents. If no specific requirements are noted, sequencer will be powered on/of from the front panel.		

Video Performance

Title	Description	Initial	Notes
Video Routing & Switching	Verify that all video signals are properly routed, switched, scaled, and displayed according to project documents.		
Projector Alignment	Verify that projectors and screens provide a projected image that is properly aligned and fills the projection area.		
Projector Alignment	Verify that projector and screen are in the correct locations, correctly aligned and keystone correction is not in use.		
Projector Interactivity	Verify that projector touch sensors are calibrated and working per manufacture instructions. Provide offset hardware as needed.		
Image Scaling	Verify that all displayed images are scaled to the full native resolution of displays and projectors in all cases where scaling hardware is specified.		
Image Quality	Verify that all displayed images are correctly focused and are free from distortion.		
Aspect Ratio	Verify that all displayed images maintain the proper aspect ratio and image geometry. Key-stoning and stretching should not be used. Any exceptions to this should be noted.		
Display Image setting	Displays are set to dot to dot or full. Images shall fill the screen without cropping.		
Signal Bandwidth	Verify that all equipment from endpoint to endpoint supports the		

© BNA Consulting

	resolution/data rate as indicated in the documents.		
System Certification	Verify system has been tested with industry standard testing equipment including the use of Quantum Data 780C		

© BNA Consulting

SECTION 28 3111

FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of fire alarm and detection systems work is indicated by drawings, schedules and as specified herein.

B. Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories. Provide components and systems that are UL-listed and labeled for fire alarm. Provide fire alarm and detection systems and accessories that are FM approved. Comply with State and local requirements as applicable.

C. Comply with applicable provisions of current NFPA Standards 72, National Fire Alarm Code, local building codes, and meet requirements of local authorities having jurisdiction.

1.3 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. MANUFACTURER: Subject to compliance with requirements, provide fire alarm and detection systems of one of the following:

1. To match existing system

B. The job foreman or lead technician shall be factory trained and certified on the system being installed. Individual shall have a minimum NICET II certification.

2.2 FIRE ALARM AND DETECTION SYSTEMS:

A. GENERAL: Provide an electrically operated, electrically supervised fire alarm system as described herein. Include control units, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. Enclose entire system in raceway. Provide basic wiring materials that comply with Division 26, Basic Materials and Methods Sections for raceways, conductors, boxes, fittings, supports, etc. Minimum wire size to be #14 AWG copper.

B. SYSTEM TYPE: Analog addressable, non-coded. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes all fire alarm signaling devices, sounding a non-coded alarm and providing device identification on an annunciator panel.

C. SYSTEM OPERATION: Provide system such that any manual station or automatic initiating device annunciates all alarm indicating units (bells, horns, buzzers, chimes, visual alarm lamps, etc.) continuously until the manual station or initiating device is restored to normal and the fire alarm control unit reset. Annunciate alarm signals by device at the control panel and all remote annunciators. Provide all conductors, raceway, equipment and labor to accomplish the following:

D. For fans that are not part of the smoke evacuation system, deactivate air supply and return fan units simultaneously by means of a supervised master fan shutdown relay with slave

© BNA Consulting

relays as required. Restart air units automatically after panel has been reset. Provide a bypass switch for master fan shut down relay for drill purposes, and indicate by a locked-in lamp that the circuit has been bypassed.

E. Selectively activate and/or deactivate fan units as required.

F. Release all magnetic door holders upon activation of an alarm from any device by use of a master relay in the control panel.

G. Provide supervised circuits for the following:

1. Close dampers upon activation of an alarm from any device through the HVAC interface relays at the Fire Command Center.

2. Recall elevators, upon activation of an alarm, to the floor of building egress unless the alarm is on the egress floor, in that case recall elevator to the level designated by the Fire Marshall. Cooperate with the elevator supplier to ensure complete operable system. Provide shunt trip breaker(s) as required.

H. Central Station Monitoring. Provide a UL listed fire control communicator in accordance with NFPA 71 with a minimum of two reporting zones to the central station. Provide a communicator with dual phone lines for central station reporting by using BFSK or pulsed single round fast format. Provide integral trouble annunciator. Provide with compatibility for automatic test reports every 24 hours. Provide system and components that comply with UL 2635 and UL 864.

I. Provide fire alarm control panel with capability of shutting down individual initiating devices for maintenance purposes without affecting the continued operation of other initiating devices.

2.3 SCOPE OF THE WORK:

A. Provide all new fire alarm devices.

B. All initiating devices connected to the fire alarm control panel shall be analog addressable.

C. All wiring shall be in conduit (3/4" minimum). All conduit and connectors, shall be made of steel. All conduit runs shall form a complete loop from the fire alarm control panel.

2.4 FIRE ALARM CONTROL PANEL (EXISTING):

A. The fire alarm control panel shall be microprocessor-based. Each loop shall be capable of 99 analog addresses and 98 monitor and/or control addresses.

B. If the microprocessor fails, the system shall execute a default signaling program. This program will enable the panel to sound the audible signals and summon the Fire Department. In addition, a red LED shall light to indicate the device wherein the alarm originated. Inability of the system to sound signals or summon the fire department during microprocessor failure shall not be acceptable.

C. The fire alarm control panel shall contain a 80 digit alphanumeric display and permit the user to perform all necessary functions including but not limited to the following:

1. Alarm/Trouble Acknowledge
2. Alarm Silence
3. Reset
4. Lamp Test
5. Control of Initiating Devices (on/off)
6. Control of output modules (on/off)
7. Change sensitivity of devices
8. Change time
9. Walk test

© BNA Consulting

10. Check system on battery voltage and current

D. The fire alarm control panel shall be capable of alarm verification. The control panel shall indicate which smoke detector is in alarm during the pre-alarm window.

E. All alarm signals shall be locked in at the panel until the operated device is returned to it's normal condition and the control panel is manually reset.

F. Alarm or trouble activation of initiating points shall be represented in English on the alphanumeric display on both the remote operating panel and the fire alarm control panel indicating the address of the specific device, i.e. Device L4S76, Smoke Detector, 1st floor Rm. 17.

G. Each initiating and signal circuit shall be electrically supervised for opens, shorts, and ground faults in the wiring.

H. The occurrence of any fault shall activate the system trouble circuitry but shall not interfere with the proper operation of any circuit that does not have a fault condition.

I. The system communication loops shall be capable of being wired using Class "A" (Style 6) supervised circuits (a ground fault on either conductor or a break shall not prevent a device from operating on either side of the break)

J. The fire alarm control panel shall contain circuitry permitting the transmission of trouble and alarm signals over leased phone lines by the means of reverse polarity. There shall be a supervised disconnect switch to allow testing of the fire alarm control panel without transmitting an alarm to the central station.

K. The fire alarm control panel shall include the following features:

1. Auxiliary SPDT alarm actuated contacts.
2. Auxiliary SPDT trouble actuated contacts.
3. A solid-state power transfer circuit that shall switch to standby power automatically and instantaneously if normal power fails or falls below 15% of normal ("brown out" conditions). This electronic circuit shall allow the batteries to be effectively "floated" on the operating system to avoid upsetting the normal microprocessor scan and minimize resultant nuisance troubles and/or alarms.
4. A ground fault detector to detect positive or negative grounds on the initiating circuits, signal circuits, power circuits, and telephone line circuit. A ground fault code on the alphanumeric display shall provide indication of either a positive or negative ground fault and shall operate a general trouble but shall not cause an alarm to be sounded
5. A short circuit error message shall be a standard feature of the fire alarm control panel. Each communication loop shall be monitored and shall have a distinctive error message.
6. Lightning protection shall be a standard feature of the fire alarm control panel and shall be incorporated in the power supply circuit, common control circuits, signal circuits, and telephone line circuit.
7. Individual circuit breakers shall be provided for the following: smoke detector power, main power supply, signal circuit #1, signal circuit #2, battery standby power, and auxiliary output.
8. The fire alarm control panel shall be of dead-front construction. One key shall allow access to all electronics or to the dead-front access to the operator functions
9. Opening the main door shall expose all components for inspection or adjustment without further dismantling of the cabinet, control unit, or wiring.
10. It shall be possible to check and adjust the sensitivity of all analog devices from the main fire alarm panel.

L. The fire alarm control panel shall have batteries capable of powering the system for (24) hours in standby condition and (5) minutes in alarm.

© BNA Consulting

M. There shall be no special tools required for the programming of devices. A standard slot head screwdriver only.

2.5 MONITOR MODULE (FCI AMM-2):

A. Remote identification module devices shall be attached to any single normally open initiating device (heat detector, waterflow switch, duct detectors, sprinkler, tamper switches, kitchen hood, pull station, etc.). The modules shall supply addressing and status information to the Fire Alarm Control Panel through the dual loop module.

2.6 CONTROL POINT MODULE (FCI AOM):

A. The control point module shall be connected to the same loop as the initiating devices, and shall provide a relay output (Form "C" 2 Amp @ 24 VDC, resistive only).

B. This relay output shall be used to perform auxiliary functions.

C. When the AOM is activated, the red "ACTIVE" LED shall be on solid. Under normal conditions, the red "ON LINE" LED shall flash.

2.7 DOOR HOLDER (FCI FM-988):

A. The door holder shall be wall mounted, semi-recessed; be powered at 120 VAC; and have 35 lbs. of holding force and be of a brushed aluminum finish.

2.8 MANUAL FIRE ALARM STATION (FCI, MS-2, W/AMM-2):

A. Provide red enclosure, manual fire alarm stations with the following features:

1. Aluminum construction, for flush mounting.
2. Addressable alarm type electrically compatible with system requirements.
3. Double Action
4. Dual-Action design requiring unit to be opened for resetting, and requiring resetting before closing. Key reset, keyed like fire control panel.

2.9 IONIZATION SMOKE DETECTORS (FCI ASD-I W/ADB-F BASE):

A. All ionization smoke detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All ionization fire detectors shall be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.10 PHOTOELECTRIC DETECTORS (FCI ASD-P W/ADB-F BASE):

A. All photoelectric detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All photoelectric detectors shall be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.11 DUCT FIRE DETECTORS (FCI DH500AC/DC WITH SAMPLING TUBE):

A. Provide ionization type with UL 268A listings. Each detector shall be equipped with a remote light. Each detector shall have (2) form "c" alarm contacts rated at 10 amps (at 120VAC).

2.12 THERMAL DETECTORS (FCI ATD WITH/ADB-F BASE):

A. Thermal detectors shall operate on the Rate-of-Rise principal. The detectors shall have a fixed temperature rating of 135 degrees Fahrenheit. Exception: in Boiler rooms, provide temperature rating of 200 degrees Fahrenheit.

© BNA Consulting

1. The heat detector shall consist of a base and a head.
2. The base shall be capable of accepting either a smoke detector or a 135 (or 200) degree heat detector.
3. The head shall automatically restore to its normal standby condition when the temperature returns to its normal range.

2.13 AUDIOVISUAL ALARM HORNS (FCI, HMF/STS SEMI-FLUSH MOUNTED OR EQUAL):

A. Provide audio-visual alarm horns with the following features:
1. Die cast or stamped steel construction, finished in red/white (color by Architect) enamel, suitable for indoor or outdoor application.
2. Capable of 90 db (UL rating) sound level at 10 feet.
3. Flush mounted
4. Integrally mounted flashing light unit, with Lexan lens with block letters “FIRE”, and minimum flash rate of ONE per second, and 110 candela minimum.
5. Electrically compatible with system requirements.
6. Horns shall sound the temporal pattern (code 3) until silenced.
7. Audiovisual alarm horns shall have the ability to silence horns while maintaining the strobe flash, until reset.
8. Mechanical horn mechanism only, electronic horns are not acceptable.
9. Maximum 24 horns per circuit, maximum 8 strobes per circuit.

B. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

2.14 STROBES (FCI Model STS, FLUSH MOUNT):

A. Provide strobe with flashing light unit, with Lexan lens with block letters “FIRE”, and minimum flash rate of ONE per second, and high intensity 110 candela minimum. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer. Furnish in Red/White (color by Architect).

2.15 CEILING MOUNT STROBES (WHEELOCK RSS24100C-FW, FLUSH MOUNT, WHITE):

A. Provide strobe UL listed for ceiling mounting, flush mounted in ceiling or concrete vaulted ceiling. Provide strobe with flashing light unit, with Lexan lens with block letters “FIRE”, and minimum flash rate of ONE per second, and 110 candela minimum.

B. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

C. Furnish in Red/White (color by Architect).

2.16 AUXILIARY RELAY (FCI, ARB-C):

A. Remote auxiliary relay boards shall be rated at 10 AMPS @ 120 VAC. A red LED shall light to indicate relay activation. All relays shall transfer on general alarm and latch on until reset. All relays shall be supervised. The control output provided can be used in conjunction with fire alarm applications (i.e. fan controls, dampers, doors, and any other general alarm control).

2.17 INITIATING MODULES:

A. Provide style "6" initiating modules capable of receiving and annunciating an alarm from any detector, even with a single fault condition on any initiating circuit.

B. Power all smoke detectors from the "Style 6" initiating loop wiring. For systems that power smoke detectors separately from the "Style 6" loop, provide monitoring for both the power

source and the independent initiating wiring, so that complete trouble and alarm indication is achieved by loop. Provide capability to operate all smoke detectors, even with a single fault condition on the smoke detector power wiring. Provide one spare initiating circuit.

2.18 SIGNALING MODULES:

A. Provide signaling as required. Provide power adequate to sound all signaling devices concurrently. Provide supervised indicating circuits for polarized 24V D.C. alarm signaling devices. Provide 2 spare signaling circuits.

B. Each signal circuit shall have a separate disconnect switch for servicing the fire alarm system. Each and every indicating circuit shall have a distinct location description. Power supply shall be at fire alarm control panel. Remote power supplies and indicating circuits will not be acceptable.

2.19 SUPPLEMENTAL NOTIFICATION CIRCUITS (FCI SNAC-4):

A. Provide supplementary notification appliance circuit panel(s) as required. The 'SNAC' shall be capable of supplying up to four, Class A, Style Z notification appliance circuits. The panel shall contain its own battery charger, regulated power supply, and shall be supervised for ground fault, overcurrent, open circuits and low battery conditions. Ground fault, battery and circuit trouble conditions shall transmit a trouble signal to the main fire alarm control panel.

2.20 DOOR HOLDER POWER SUPPLY (FCI #(PS5-BFS-24-UL):

A. Door holders shall be powered by a power supply separate from the fire alarm system power supply. The power supply shall have its own battery back-up capable of holding all doors for a minimum of one hour on the loss of 120vac supply power.

2.21 SYSTEM CONFIGURATION PROGRAMMING:

A. To help the owner in programming, system changes, and servicing, the fire alarm system shall have the following functions.

1. The FACP shall be capable of an auto-configuration, that via a password, all analog devices and panel modules are automatically programmed into the system. At this point the system will operate as a general alarm system without any other programming.
2. If any two devices are addressed the same, the LED's on both devices will light steady and the panel will read "extra address and the address number".
3. If any device is installed and not programmed into the system the LED will light steady and the panel will read the same as above.

2.22 BATTERIES/POWER SUPPLIES:

A. Provide standby batteries capable of operating fire alarm system for minimum of 24 hours, then operating all indicating units for at least five minutes. Locate batteries in fire alarm control unit, or in similar type enclosure located as directed. Provide all interconnecting wiring. Place batteries that vent hydrogen gas in separate enclosure. Provide 30 percent spare capacity.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Approved Plans: A copy of the approved and stamped plans shall be on site during the installation and at the time of inspection to verify that the system is installed according to the approved plans.

B. Install fire alarm and detection systems as indicated, in accordance with equipment

manufacturer's written instructions and complying with applicable portions of NEC and NECA's "standard of installation".

C. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 26 Basic Materials and Methods section, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings", and in accordance with other sections, as applicable.

D. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protective signaling circuit cable per NEC, Article 760.

E. If twisted or shielded wire is required or recommended by the manufacturer it must be used.

F. Review proper installation procedure for each type of device with equipment supplier before installation.

G. Where smoke or heat detectors are specified, install device a minimum of three feet from adjacent air supply diffusers to ensure proper operation of device.

H. Refer to NFPA for spacing and exact placement of fire alarm devices.

I. Electrical Identification: Refer to Section 260553 for requirements.

PART 4 - FINAL ACCEPTANCE AND GUARANTEE

4.1 GUARANTEE:

A. Furnish a three-year guarantee for all equipment, materials and installation, including all labor, transportation, and equipment.

B. Emergency Response. The fire alarm equipment supplier shall provide an emergency response within four hours of any reported system failure to resolve the problem on a continuous basis.

4.2 PRE-TEST:

A. The contractor shall with a representative of the manufacturer conduct a test 3 days before the final test to verify operation of all devices. Any problems must be corrected before the final test.

4.3 FINAL TEST:

A. Before the installation shall be considered completed and acceptable, a test on the system shall be performed as follows:

1. The contractor's job foreman, a representative of the manufacturer, a representative of the owner, shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel. Fan shutdown and door holder circuits shall operate.

2. Conduct a full 24 hour test of battery operation. System shall be put on the batteries for a full 24 hours and all notification appliances shall be operational for a period of 5 minutes.

The supervisory circuitry of the initiating and indicating circuits shall also be verified.

4.4 SPARE PARTS: Refer to Section 26 0502 for requirements.

PART 5 - AS BUILT DRAWINGS AND OPERATION AND MAINTENANCE MANUALS:

5.1 LABELING:

A. All devices shall be labeled with their appropriate address. The labels shall be 18 point pressure sensitive labels.

B. All initiating devices shall be programmed to include the device address and a complete user text English location description, i.e. Device L4S76, Smoke Detector, 1st floor Rm.17

© BNA Consulting

5.2 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

5.3 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

5.4 TRAINING:

A. Provide four (4) hours training on the operation and installation of fire alarm system, at job site, at no cost to owner. Provide programming training and software sub-licensing in owner's name. Sub-licensing agreement shall include the U.L. requirement to allow the owner to do any programming that the supplier is allowed to do during commissioning, testing, service and field additions or deletions to the fire alarm system. The fire alarm supplier shall provide this training and licensing at no cost to the owner, including transportation (if outside Ogden), lodging, meals, and training manuals.

END OF SECTION 28 3111

© BNA Consulting