ADDENDUM No. 02

TO CONTRACT DOCUMENTS ENTITLED:

CP200671 Lottes 1st Floor Renovation Phase One
at
9 Hospital Dr
Building #37144
Columbia, MO

Advertisement Date: March 19, 2020
Prepared for: The Curators of the University of Missouri

Consultants:
ARCHITECT
Simon Oswald Architecture
2801 Woodard Drive, Suite 103
Columbia, MO 65202
573-443-1407

MEP ENGINEER
Timberlake Engineering
912 Old 63 South
Columbia, MO 65201
573-875-4365

Drawings and Project Manual for the above referenced project and the work covered thereby are herein modified as follows, and except as set forth herein, otherwise remain unchanged and in full force and effect:

PROJECT MANUAL:

1) Advertisement for Bids
   a. Revise bid deadline accordingly:
      i. Delete: “until 10:30 a.m., C.T., April 15, 2020”
      ii. Replace: “until Date To Be Determined”

2) Table of Contents
   a. Revise accordingly:
      i. Delete 1.B.1 Bidder’ Statement of Qualifications for Asbestos Abatement (2 pages)
      ii. Delete 1.E.7 Commissioning Plan [N/A]
      iii. Add 1.E.7 Commissioning Checklist (13 pages)
      iv. Delete 08 7113 Automatic Door Operators (6 pages)
      v. Delete 07 2619 Topical Moisture Vapor Mitigation System (3 pages)
      vi. Add 26 0572 - Overcurrent Protective Device Short-Circuit Study (5 pages)
      vii. Add 26 0573 - Overcurrent Protective Device Coordination Study (6 pages)
      viii. Add 26 0574 - Overcurrent Protective Device Arc-Flash Study (5 pages)
      ix. Add 28 4621.11 - Addressable Fire-Alarm Systems Study (14 pages)

3) Section 1.A BID FOR LUMP SUM CONTRACT
   a. Replace specification section in its entirety with the attached “ADD 02 - SECTION 1.A BID FOR LUMP SUM CONTRACT”

4) Section 1.B.1 BIDDER’S STATEMENT OF QUALIFICATIONS FOR ASBESTOS ABATEMENT
   a. Remove specification section in its entirety (Clarification: No asbestos abatement is required. The asbestos survey is available from the owner upon request.)

5) Section 1.E SPECIAL CONDITIONS
   a. At Paragraph 2. SPECIAL SCHEDULING REQUIREMENTS, replace subparagraph c. with the following: “The Lottes Library building will not be available for contractor access until 06/01/2020”
   b. Replace Paragraph 12. PERMITS in its entirety with the following:
      a. “Before commencement of Boilers, Water Heaters or Pressure Vessels the Contractor must obtain an installation permit from the State of Missouri, Division of Fire Safety, Boiler and
b. Permits and inspection for work on UM property are required.
   (1) The Owners Representative shall secure University Authority Having Jurisdiction Building Permits and Certificate(s) of Occupancy required for the project and shall provide a list of required inspections to the Contractor.
   (2) The Contractor shall coordinate and provide reasonable scheduling and access to the Work for the Owner's Building Permit Agent inspection.
   (3) Re-inspection of work as a result of either failed inspection or work not ready as scheduled may be at the Contractor’s expense.”

c. At Paragraph 26. PROJECT MANAGEMENT/COMMUNICATION REQUIREMENTS, replace subparagraph a. with the following:
   “A competent full-time Project Manager shall be assigned from the beginning of the work until its final acceptance. The Contractor shall be represented at the site by a full-time, competent superintendent with no other assigned duties or responsibilities from the beginning of the work until its final acceptance, unless otherwise permitted by the Owner’s Representative. The superintendent for the Contractor for the general building work shall exercise general supervision over all subcontractors of any tier engaged on the work with decision-making authority of the Contractor.”

6) Section 1.E.7 COMMISSIONING CHECK LIST
   a. Add specification section in its entirety with the attached “ADD 02 - SECTION 1.E.7 COMMISSIONING CHECKLIST”

7) 07 2619: TOPICAL MOISTURE VAPOR MITIGATION SYSTEM
   a. Remove this specification section in its entirety (Clarification: moisture mitigation is not required)

8) 08 7100: DOOR HARDWARE
   a. Remove from 3.7 Door Hardware Schedule, Group 1 all references to door operators (Clarification: door operators are not included anywhere in the project)

9) 08 7133: AUTOMATIC DOOR OPERATORS
   a. Remove this specification section in its entirety (Clarification: door operators are not included anywhere in the project)

10) 09 5113: ACOUSTICAL PANEL CEILINGS
    a. Revise Section 2.4 B accordingly:
       i. Delete: 9/16-inch
       ii. Replace: 15/16-inch

11) 09 6813: TILE CARPETING
    a. Add to Section 1.4 A the following text: “1. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcoverings Installers Association at the Commercial II certification level.”

12) 26 0572: OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY
    a. Add specification section in its entirety with the attached “ADD 02 - SECTION 260572”

13) 26 0573: OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
    a. Add specification section in its entirety with the attached “ADD 02 - SECTION 260573”

14) 26 0574: OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY
    a. Add specification section in its entirety with the attached “ADD 02 - SECTION 260574”

15) 28 4621.11: ADDRESSABLE FIRE-ALARM SYSTEMS
    a. Add specification section in its entirety with the attached” ADD 02 - SECTION 284621.11”
16) **APPENDIX A: INTERIOR FINISH KEY**  
a. At Casework replace text as follows for PL-1 and PL-2:  
   i. Delete: "Fundamental Stone"  
   ii. Replace: "Elemental Stone 8831-58"  
b. At Metal Support Brackets replace text as follows for MB-1:  
   i. Delete: "Alternate #1"  
   ii. Replace: "Alternate #3"

**DRAWINGS:**

17) **A101 – FIRST FLOOR DEMO PLAN**  
a. Add the following text to the end of Keynote 07: “CONTRACTOR TO REMOVE EXISTING WALL BASE WHERE REQUIRED FOR INSTALLATION OF NEW WALL BASE.”  
b. Add the following text to the end of Keynote 10: “EXISTING CARPET IS APPROXIMATELY 10 YEARS OLD AND INSTALLED WITH QUICK-RELEASE ADHESIVE.”

18) **A102 – FIRST FLOOR DEMO REFLECTED CEILING PLAN**  
a. Add the following General Note 06: "UNDERSIDE OF EXISTING 2ND FLOOR ASSEMBLY IS 12' - 6 3/4" ABOVE 1ST FLOOR LEVEL. UNDERSIDE OF EXISTING SOFFITS ARE 8' - 7 1/2" ABOVE 1ST FLOOR LEVEL.”

19) **A202 – FIRST FLOOR REFLECTED CEILING PLAN**  
a. Add the following text to the end of Keynote 01: "– FOR REFERENCE"  
b. Revise Keynote 07 to read as follows: “REINSTALL SALVAGED CEILING TILE THIS AREA. EXISTING CEILING TILE VARIES PER SPACE. THE INTENTION IS TO TEMPORARILY REMOVE CEILING TILE AND GRID IN THIS AREA TO PERFORM ABOVE-CEILING WORK AND THEN TO REINSTALL THIS SAME ‘SALVAGED’ CEILING TILE.”  
c. Delete the three (3) instances of Keynote 13 north of column line B, between column lines 4 and 6.

20) **A701 – ROOM FINISH SCHEDULES AND FINISH PLAN**  
a. Add the following rooms and finish information to the Room Finish Schedule:  
   i. HSL 180, CUSTODIAL, FLOORING: EXPOSED EXISTING CONCRETE, BASE: RB-1, ALL WALLS: IPS-1A, CEILING: EXISTING  
   ii. HSL 172, CORR, FLOORING: CT-1, BASE: RB-1, ALL WALLS: IPS-1A, CEILING: ACT-1, NOTE 1  
b. Add the following General Finish Note: “G12. WALL FINISHES TO EXTEND TO FINISH CEILING.”  
c. Remove the following text from General Finish Note G8: “AND IPS-2B IN EXISTING LIBRARY AREA”

21) **A702 – DOOR FINISH SCHEDULES**  
a. Delete from Detail 03 the following text: “W/ 4" BACKSPLASH”

22) **DE101 – FIRST FLR. POWER DEMO PLAN**  
a. Replace this sheet in its entirety with the attached “ADD 02 - DE101”

**ATTACHMENTS:**
ADD 02 - DE101  
ADD 02 - SECTION 1.E.7 COMMISSIONING CHECKLIST  
ADD 02 - SECTION 1.A BID FOR LUMP SUM CONTRACT  
ADD 02 - SECTION 260572  
ADD 02 - SECTION 260573  
ADD 02 - SECTION 260574  
ADD 02 - SECTION 284621.11

**ADDITIONAL INFORMATION:**
Photos from Pre-Bid.zip  
CP200671 Lottes PreBid Meeting Attendee List

*End of Addendum #02*
3. All receptacles on demo'd walls shall be demo'd. Remove all conduit and conductors back to origin. See key notes.

2. All gear, receptacles, conduit, and conductors labeled 'EX' or 'EXISTING' shall be existing to remain unless noted otherwise.

4. All existing gear, conduit, and devices shown are an approximation based on existing plans, specifications, and field surveys. Contractor shall field verify exact locations of gear, receptacles, and devices prior to start of construction. Provide report to owners representative of all deviations which will affect architectural plans for demo'd wall locations.

1. Refer to E501 and E601 for remaining power notes, legends, details & schedules.

Key notes:
- Second Flr. Power Demo Plan
- First Flr. Power Demo Plan
- General notes
- Key notes
SECTION 1.A

BID FOR LUMP SUM CONTRACT

Date:____________________________

BID OF ____________________________________________
(hereinafter called "Bidder") a corporation* organized and existing under laws of the State of __________________________
a partnership* consisting of ____________________________
an individual* trading as _______________________________
a joint venture* consisting of ___________________________

*Insert Corporation(s), partnership or individual, as applicable.

TO: Curators of the University of Missouri
   c/o Associate Vice Chancellor – Facilities
   Room L100 General Service Building
   Columbia, MO 65211

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by Simon Oswald Associates, Inc., entitled "LOTUSES 1ST FLOOR RENOVATION PHASE ONE", project number CP200671, dated March 19, 2020 having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri’s tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

Bidder acknowledges receipt of following addenda:

Addendum No. ________________________________ Dated _____________
Addendum No. ________________________________ Dated _____________
Addendum No. ________________________________ Dated _____________
Addendum No. ________________________________ Dated _____________

2. In following Bid(s), amount(s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.

3. BID PRICING
   a. Base Bid:
      The Bidder agrees to furnish all labor, materials, tools, and equipment required to renovate approximately 6,968 s.f. of the first floor of Lottes Health Sciences Library for conversion to School of Medicine and Department of Anesthesiology Department offices; all as indicated on the Drawings and described in these Specifications for sum of:

      ___________________________________________________ DOLLARS ($____________________).
b. Additive Alternate Bids:

Above Base Bid may be changed in accordance with following Alternate Bids as Owner may elect. Alternates are as described in Section 1.H of Project Manual. Alternates are written in a priority order, but Owner is not required to accept or reject in order listed. This is a one (1) contract project, therefore, Alternates shall be studied by each Bidder to determine effect on Bids of Contractor and each Subcontractor and/or Material supplier.

(1) Additive Alternate No. 1: Replace School of Medicine Corridor Floor Tile

All for sum of:

__________________________ DOLLARS ($__________).

(2) Additive Alternate No. 2: Replace School of Medicine Corridor Ceiling and Lighting

All for sum of:

__________________________ DOLLARS ($__________).

(3) Additive Alternate No. 3: Dept. of Anesthesiology – Add eight (8) Countertop Desks

All for sum of:

__________________________ DOLLARS ($__________).

c. Unit Prices:

(1) For changing specified quantities of work from those indicated by Contract Drawings and Specifications, upon written instructions of Owner, the following Unit Prices shall prevail in accordance with General Conditions.

(2) The following Unit Prices include all labor, overhead and profit, materials, equipment, etc., to cover all work.

(3) The following Unit Prices are required where applicable to particular Base Bid and/or Alternate being submitted.

(4) Only a single Unit Price shall be given and it shall apply for either MORE or LESS work than that indicated on Drawings and called for in Specifications as indicated to be included in Base Bid and/or Alternates. In the event that more or less units than so indicated is actually furnished, Change Orders will be issued for increased or decreased amounts as approved by the Owner.

(5) Bidder understands that the Owner will not be liable for any Unit Price or any amount in excess of Base Bid and any Alternate(s) accepted at time of award of Contract, except as expressed in written Change Orders duly executed and delivered by Owner's Representative.
FILL IN ONLY ONE PRICE PER LINE

(6) Interior drywall skim coat as defined in Division 9 and drawing A201/02 FIRST FLOOR NEW WORK PLAN Keynote 03

(a) Skim Coat
Base Bid Quantity per Allowance (item d below) at $________________/sq. ft.

d. Allowance:
Bidder shall include in the base bid sum an allowance of $___________ for 900 sq. ft. of skim coating of existing drywall partitions within the work area. This allowance amount shall not include contractor's overhead and profit. The Contractor shall include overhead and profit on the allowance amount in his bid.

4. PROJECT COMPLETION

a. Contract Period - Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." The anticipated award of contract date is 05/19/20. Bidder agrees to substantially complete project within eighty four (84) calendar days. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned documents from Bidder.

b. Commencement - Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.

c. Special scheduling requirements:
1) The Lottes Library building will not be available for contractor access until 06/01/2020.
2) Lottes Health Sciences Library will be occupied on the second and third floors above the first floor project area. Activities will be ongoing in the building and work affecting occupants must be coordinated with the Owner's Representative.
3) Contractor shall perform all work in the designated areas during regular working hours, which are 7:00 a.m. to 5:00 p.m., Monday through Friday. Contractor may gain access to the project area prior to, or after, regular working hours if coordinated with the Owner's Representative.
4) Contractor shall not perform any work of any kind on 08/06/2020 and 08/07/2020. Student Testing in Lottes Library is scheduled for those dates.

5. SUBCONTRACTOR LIST:

Bidder hereby certifies that the following subcontractors will be used in performance of Work:

NOTE: Failure to list subcontractors for each category of work identified on this form or listing more than one subcontractor for any category of work without designating the portion of work performed by each shall be grounds for rejection of bid. List name, city, and state of designated subcontractor, for each category of work listed in Bid For Lump Sum Contract. If work within a category will be performed by more than one subcontractor, Bidder shall provide name, city, and state of each subcontractor and specify exact portion of work to be performed by each. If acceptance/non-acceptance of Alternates will affect designation of a subcontractor, Bidder shall provide information, for each affected category, with this bid form. If Bidder intends to perform any designated subcontract work by using Bidder's own employees, then Bidder shall list their own name, city, and state. The bidder may petition the Owner to change a listed subcontractor only within 48 hours of the bid opening. See Information For Bidders Section 16 List of Subcontractors for requirements.
6. SUPPLIER DIVERSITY PARTICIPATION GOALS
   a. The Contractor shall have as a goal, subcontracting with Minority Business Enterprise (MBE) of ten (10%), with Service Disabled Veteran Owned Business (SDVE) of three percent (3%); and with Women Business Enterprise (WBE), Disadvantage Business Enterprise (DBE), and/or Veteran Owned Business of ten (10%) of awarded contract price for work to be performed.

   b. Requests for waiver of this goal shall be submitted on the attached Application For Waiver form. A determination by the Director of Facilities Planning & Development, UM, that a good faith effort has not been made by Contractor to achieve above stated goal may result in rejection of bid.

   c. The Undersigned proposes to perform work with following Supplier Diversity participation level:

   MBE PERCENTAGE PARTICIPATION: __________________________ percent (%)
   SDVE PERCENTAGE PARTICIPATION: __________________________ percent (%)
   WBE, DBE, and/or VETERAN PERCENTAGE PARTICIPATION: _______ percent (%)

   d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGMENTS
   a. Bidder declares that he has had an opportunity to examine the site of the work and he has examined Contract Documents therefore; that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions, or correction of bid after scheduled closing time for receipt of bids.

   b. Bidder agrees that bid shall not be withdrawn for a period of ninety (90) days after scheduled closing time for receipt of bids.

   c. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.

   d. Accompanying the bid is a bid bond, or a certified check, or an irrevocable letter of credit, or a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.

   e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications on file.
f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.

b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.

c. He has not solicited or induced any person, firm or corporation to refrain from bidding.

d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.

e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.

f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."
9. **BIDDER'S SIGNATURE**

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

<table>
<thead>
<tr>
<th>Authorized Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td>Printed Name</td>
<td>Title</td>
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<td>Company Name</td>
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<td>Mailing Address</td>
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<td>E-Mail Address</td>
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<td>Circle one:</td>
<td>Individual</td>
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<td>If a corporation, incorporated under the laws of the State of__________</td>
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<td>Licensed to do business in the State of Missouri?</td>
<td>yes</td>
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(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

**END OF SECTION**
## Commissioning Check List

<table>
<thead>
<tr>
<th>Commissioning Items by CSI Division</th>
<th>Verified by</th>
<th>Date compl</th>
<th>Coord Initial</th>
<th>Documentation Required</th>
<th>Owner Witness Required</th>
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<tbody>
<tr>
<td>1 Building System Commissioning</td>
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<td>Commissioning Agent - Conduct pre-installation meetings per specifications.</td>
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<td>Meeting Minutes</td>
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<td>24119 Selective Demolition</td>
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<td>✓</td>
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<td>Clean adjacent structures and improvements of dust, dirt and debris caused by selective demolition operations. Return adjacent areas to conditions existing before demolition.</td>
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<td>Do not start demolition until utility disconnect and sealing has been verified in writing</td>
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<td>33053 Miscellaneous Cast-In-Place Concrete</td>
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<td>Provide a Copy Of Field Cured Concrete Cylinder Test Report to Owner's Rep Prior to Stripping Any Load Bearing Formwork</td>
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<td>Test Report From Independent Testing Lab</td>
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<td>79200 Joint Sealants</td>
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<td>Clean out joints immediately before installing joint sealant</td>
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<td>81213 Hollow Metal Frames</td>
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<td>Check and readjust all operating finish hardware and doors and fire rating tags</td>
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<td>itemized list of doors</td>
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<tr>
<td>81416 Flush Wood Doors</td>
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<td>Check and readjust all operating finish hardware and doors and fire rating tags</td>
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<td>Door Hardware</td>
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<td>Hold Preinstallation Meetings as specified</td>
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<td>Meeting Minutes</td>
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<td>Verify and test all electric strikes and door positioning hardware for proper operation</td>
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<td>Verify door closures comply with ADA requirements</td>
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<td>Verify that all fire doors close and latch positively</td>
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<td>test report</td>
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<td>Glazing</td>
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<td>Wash clear glass on both faces not more than 4 days prior to punch list inspection</td>
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<td>Gypsum Board</td>
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<td>Verify fire rating compliance is maintained, including all wall penetrations</td>
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<td>Ceramic Tiling</td>
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<td>Construct mock-ups per specifications</td>
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<td>Furnish extra material as specified</td>
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<td>Transmittal</td>
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<td>Hold Preinstallation meetings as specified</td>
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<td>Meeting Minutes</td>
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4/8/2020

COM 2 of 11
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<th>Commissioning Items by CSI Division</th>
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<td>95113 Acoustical Panel Ceilings</td>
<td></td>
<td></td>
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<td></td>
<td>✓</td>
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<tr>
<td>Ensure that all debris is removed from above ceiling tiles during final above ceiling inspection.</td>
<td></td>
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<tr>
<td>Furnish Extra Material as specified</td>
<td></td>
<td></td>
<td></td>
<td>Transmittal</td>
<td>✓</td>
</tr>
<tr>
<td>96513 Resilient Base and Accessories</td>
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<tr>
<td>Furnish extra material as specified</td>
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<td>Transmittal</td>
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<tr>
<td>96813 Tile Carpeting</td>
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<td>Furnish Extra Material as specified</td>
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<td>Transmittal</td>
<td>✓</td>
</tr>
<tr>
<td>Protect installed flooring per specifications</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>102800 Toliet &amp; Bath &amp; Laundry Accessories</td>
<td></td>
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<td></td>
<td>✓</td>
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<tr>
<td>Adjust and clean per specifications.</td>
<td></td>
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<tr>
<td>210518 Escutcheons for Fire-Suppression Piping</td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
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<tr>
<td>Perform Field Quality Control section of specifications</td>
<td></td>
<td></td>
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<tr>
<td>211313 Wet-Pipe Sprinkler System</td>
<td></td>
<td></td>
<td></td>
<td>Test certification. NFPA 13 Certificate.</td>
<td>✓</td>
</tr>
<tr>
<td>Coordinate operation with fire alarm test</td>
<td></td>
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<tr>
<td>Commissioning Items by CSI Division</td>
<td>Verified by:</td>
<td>Date compl</td>
<td>Coord Initial</td>
<td>Documentation Required</td>
<td>Owner Witness Required</td>
</tr>
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</tr>
<tr>
<td>Fill water system and flush system</td>
<td></td>
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<tr>
<td>Perform Field Quality Control as specified</td>
<td></td>
<td></td>
<td></td>
<td>NFPA 13 Certificate</td>
<td>✔</td>
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<tr>
<td>Verify interlock testing with fire alarm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
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<tr>
<td><strong>220518</strong></td>
<td>Escutcheons for Plumbing Piping</td>
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<tr>
<td>Perform Field Quality Control section of specifications</td>
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<tr>
<td><strong>220523</strong></td>
<td>General Duty Valves for Plumbing Piping</td>
<td></td>
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<tr>
<td>Check valves for leaks and replace in necessary</td>
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<tr>
<td><strong>220553</strong></td>
<td>Identification for Plumbing Piping and Equipment</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Install pipe markers per specifications</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>220719</strong></td>
<td>Plumbing Equipment Insulation</td>
<td></td>
<td></td>
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<tr>
<td>Verify correct type, thickness and jacket installed</td>
<td></td>
<td></td>
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<tr>
<td><strong>Plumbing Piping Insulation</strong></td>
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<tr>
<td>Perform Field Quality Control section of specifications</td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
<td>✔</td>
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<tr>
<td>Commissioning Items by CSI Division</td>
<td>Verified by:</td>
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<td>Date compl</td>
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</tr>
</tbody>
</table>

**221116**

**Domestic Water Piping**

- Fill and flush each system
- Flush, chlorinate, and reflush the potable water system. Take water sample at farthest point in system and perform test by approved lab.
- Provide pressure testing per Field Quality Control section of specifications
- Remove and clean strainer screens

**221316**

**Sanitary Waste and Vent Piping**

1. Verify rough-in complete prior to slab pour or wall installation
2. Inspect, test and commission per specifications

**221319**

**Sanitary Drains**

- Submit room by room schedule of floor drains and cleanouts prior to installation.

**230518**

**Escutheons for HVAC Piping**

- Perform Field Quality Control section of specifications
<table>
<thead>
<tr>
<th>Commissioning Items by CSI Division</th>
<th>Verified by:</th>
<th>Firm</th>
<th>Date compl</th>
<th>Coord Initial</th>
<th>Documentation Required</th>
<th>Owner Witness Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>230553</strong> Identification for HVAC Piping and Equipment</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Install pipe markers per specifications</td>
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<tr>
<td><strong>230713</strong> Duct Insulation</td>
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<td>Test Report</td>
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<tr>
<td>Perform Field Quality Control section of specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Verify fire rating at fire dampers, walls, floors, ceilings and roof</td>
<td></td>
<td></td>
<td></td>
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<td>□</td>
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<tr>
<td><strong>230719</strong> HVAC Piping Insulation</td>
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<td>Test Report</td>
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<tr>
<td>Perform Field Quality Control section of specifications</td>
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<td></td>
<td>✔</td>
</tr>
<tr>
<td>Verify all piping unions are accessible for maintenance</td>
<td></td>
<td></td>
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<tr>
<td><strong>230900</strong> Control Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
<td></td>
</tr>
<tr>
<td>Calibrate/fine tune circuits &amp; equipment to achieve specified sequence of operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Check and record amp draw on supply transformers of I/O panels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Ensure shipping material has been removed from thermostats and other control devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>□</td>
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<tr>
<td>Post laminated control diagram in mechanical room</td>
<td></td>
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</table>

4/8/2020 COM 6 of 11
<table>
<thead>
<tr>
<th>Commissioning Items by CSI Division</th>
<th>Verified by:</th>
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<th>Owner Witness Required</th>
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</thead>
<tbody>
<tr>
<td>Start, test and adjust controls and safeties</td>
<td></td>
<td></td>
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<tr>
<td>Verify power to all EMCS panels and equipment is complete</td>
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<tr>
<td><strong>232113</strong></td>
<td></td>
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<tr>
<td><strong>Hydronic Piping</strong></td>
<td></td>
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</tr>
</tbody>
</table>
| Clean and flush per specifications | | | | | | ✔
| Test piping per Field Quality Control section of specifications for 1 hour - NOT 10 minutes. | | | | | | ✔
| Verify expansion tanks to ensure they are filled to the proper level. | | | | | | |
| Verify operating temperature of hot water system | | | | | | |
| **233113** | | | | | | |
| **Metal Ducts** | | | | | | |
| test for duct leakage per "Testing" section of spec. Ducts shall meet leakage requirement prior to testing and balancing | | | | | | ✔
| **233300** | | | | | | |
| **Air Duct Accessories** | | | | | | |
| Demonstrate Proper Operation of All Fire Dampers per NFPA-90A. | | | | | | ✔
| Perform Field Quality Control section of specifications | | | | | | ✔

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<table>
<thead>
<tr>
<th>Commissioning Items by CSI Division</th>
<th>Verified by:</th>
<th>Name</th>
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<th>Date compl</th>
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<th>Documentation Required</th>
<th>Owner Witness Required</th>
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<tbody>
<tr>
<td>233423 HVAC Power Ventilators</td>
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<tr>
<td>Commission per specifications</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Conduct Training</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Sign in sheet</td>
<td></td>
</tr>
<tr>
<td>Perform Field Quality Control section of specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
<td></td>
</tr>
<tr>
<td>233600 Air Terminal Units</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Notify owner's rep after fully installing a representative unit (in-place mockup) for approval. Coordinate and cooperate with owner's commissioning of the boxes.</td>
<td></td>
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<tr>
<td>Perform Demonstration section of specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sign-in Sheet</td>
<td></td>
</tr>
<tr>
<td>Perform Field Quality Control section of specifications</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Test Report</td>
<td></td>
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<tr>
<td>260519 Low-Voltage Electrical Power Conductors and Cables</td>
<td></td>
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<tr>
<td>Ensure wires are color coded per specifications</td>
<td></td>
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</tr>
<tr>
<td>Perform megohm/high pot tests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>test report</td>
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</tr>
<tr>
<td>Commissioning Items by CSI Division</td>
<td>Verified by:</td>
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<td>Owner Witness Required</td>
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<tr>
<td>260526 Grounding and Bonding for Electrical Systems</td>
<td>Name</td>
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<tr>
<td>Perform resistance test as described in &quot;Field Quality Control&quot; section of spec</td>
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<td></td>
<td>test report</td>
<td></td>
<td></td>
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<tr>
<td>260553 Identification for Electrical Systems</td>
<td>Name</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Verify all equipment, panels, conduits and conductors are correctly labeled.</td>
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<tr>
<td>260573 Overcurrent Protective Device Coordination Study</td>
<td>Name</td>
<td></td>
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</tr>
</tbody>
</table>
| Factory certified technician to set electronic overcurrent devices to approved coordination study setpoints. Per field adjusting section of specs. | | | | | Inspection Report | ✔
| Train owners representatives in setting of overcurrent devices per Demonstration section of specifications. | | | | | Sign-up Sheet | ✔
| 260574 Arcflash Study | Name | | | | | |
| Place arcflash labels on equipment as specified | | | | | Inspection report | ✔
| 260923 Lighting Control Devices | Name | | | | | |
| Perform Field Quality Control section of specifications | | | | | field report | ✔
| Provide factory training per Demonstration section of specifications | | | | | Sign In Sheet | ✔

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<table>
<thead>
<tr>
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<th>Owner Witness Required</th>
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<tr>
<td><strong>262726</strong> Wiring Devices</td>
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<tr>
<td>Check all receptacles for proper operation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Operate All Devices per &quot;Field Quality Control&quot; section of spec to verify correct operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
<td></td>
</tr>
<tr>
<td><strong>265119</strong> LED Interior Lighting</td>
<td></td>
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<tr>
<td>Perform Field Quality Control section of specifications</td>
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<td></td>
<td></td>
<td>Test Report</td>
<td></td>
</tr>
<tr>
<td>Perform Startup Service section of specifications</td>
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<td></td>
<td>Startup Report</td>
<td></td>
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<tr>
<td><strong>265219</strong> Emergency and Exit Lighting</td>
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<td></td>
</tr>
<tr>
<td>Perform Field Quality Control section of specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
<td></td>
</tr>
<tr>
<td>Test Emergency Lighting fixtures for proper operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test Report</td>
<td></td>
</tr>
<tr>
<td><strong>284621</strong> Addressable Fire-Alarm Systems</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Perform Demonstration section of specifications</td>
<td></td>
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<td></td>
<td></td>
<td>Sing in sheet</td>
<td></td>
</tr>
<tr>
<td>Perform Field Quality control section of specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NFPA72 Certification</td>
<td></td>
</tr>
<tr>
<td>Test system operation of pull stations horns/strobes by factory trained representative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Written certification of fire alarm system per NFPA</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Commissioning Items by CSI Division</th>
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</thead>
<tbody>
<tr>
<td>Verify battery power available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify control station automatic signaling for each addressable device</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify door hardware interlock</td>
<td>✔️</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Verify HVAC (Metasys) interlock</td>
<td>✔️</td>
<td></td>
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</tr>
</tbody>
</table>
Construction Management Checklist for Energizing Utilities
(Contractor to initial each item upon completion and provide completed
form to the Owner's Representative prior to energizing utility)

Water – turned on to the first valve past Energy Management's last valve.

- Review all piping and equipment being turned on for proper installation and completed testing.
- Insulation installed (preferred but not required).
- Meter properly installed, working, and in readable location.
- Contractor has swabbed out with chlorine all piping from the backflow preventer to the source while installing.
- All bacteriological tests have been completed and passed.
- Backflow preventer installed and tested. (will need water pressure to test)
- Pressure test completed in piping being turned on.
- Contractor has method to communicate "Services On" to other contractor personnel and Owner's personnel.
- Consultant has signed off

Steam – turned on to the first valve past Energy Management's last valve.

- Review all piping, equipment, valves, reducing stations, relief valves, etc. for proper installation and complete testing.
- Piping protected from the weather.
- Insulation must be installed.
- All hangers and bolts have been installed.
- Meter installed, working and in readable location. (Don't need metasys to turn on.)
- All needed traps are installed and able to be tested as they are turned on.
- Condensate system is installed and operating including the pumping system.
- Pressure test completed in piping being turned on.
- Contractor has method to communicate "Services On" to other contractor personnel and Owner's personnel.
- Consultant has signed off

Condensate – turned on to the first valve past Energy Management's last valve.

- Review all piping and equipment being turned on for proper installation and completed testing.
- Piping protected from the weather.
- Insulation installed (preferred but not required).
- Pressure test completed in piping being turned on.
- Contractor has method to communicate "Services On" to other contractor personnel and Owner's personnel.
- Consultant has signed off

Electric – turned on to the first breaker past 13.8kV transformer.

- Review all wiring and equipment being turned on for proper installation and completed testing.
- GFCI set and tested.
- Breakers set and tested.
- All needed permanent grounds are installed.
- Meter installed, working and in readable location.
- Main switchgear protected from the weather.
- Contractor has method to communicate "Services On" to other contractor personnel and Owner's personnel.
- Consultant has signed off

Chilled Water – turned on to the first valve inside of building.

- Review all piping and equipment being turned on for proper installation and completed testing.
- Insulation must be installed.
- Meter installed, working and connected to Metasys.
- Building pump and automatic isolation/control valve must be installed and under control.
- If chillers are installed, automatic loop pump isolation must be installed.
- Control valves must be installed and automatically controlled on all loads.
- Contractor has method to communicate "Services On" to other contractor personnel and Owner's personnel.
- Consultant has signed off
Please see following website for suggested commissioning forms:

https://www.cf.missouri.edu(cf/pdc/commissioning-forms)
SECTION 260572 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.2 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

   a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
   b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate mandatory features as listed in IEEE 399.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.


G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:
      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.
   1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
   2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the following input data to support the short-circuit study:
   1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Obtain electrical power utility impedance at the service.
   3. Power sources and ties.
   4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
8. Motor horsepower and NEMA MG 1 code letter designation.
9. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.
B. Calculate short-circuit currents according to IEEE 551.
C. Base study on the device characteristics supplied by device manufacturer.
D. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:
   1. To normal system low-voltage load buses where fault current is 10 kA or less.
   2. All three phase branch circuits with overcurrent protective device ratings greater than or equal to 30 amps.
E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
F. The calculations shall include the ac fault-current decay from induction motors. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:
   1. Electric utility's supply termination point.
   2. Incoming switchgear.
   3. Low-voltage switchgear.
   4. Motor-control centers.
   5. Control panels.
   6. Automatic transfer switches.
   8. Disconnect switches.
3.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 260572
SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.2 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

   1) One-line diagram.
   2) Protective device coordination study.
   3) Time-current coordination curves.
b. Power system data.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society’s Certified Software Development Professional certification.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

   1. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate mandatory features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations.
D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
   a. Phase and Ground Relays:
      1) Device tag.
      2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
      3) Recommendations on improved relaying systems, if applicable.
   b. Circuit Breakers:
      1) Adjustable pickups and time delays (long time, short time, ground).
      2) Adjustable time-current characteristic.
      3) Adjustable instantaneous pickup.
      4) Recommendations on improved trip systems, if applicable.
   c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
   a. Power utility's overcurrent protective device.
   b. Low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
   c. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
   d. Transformer full-load current, magnetizing inrush current.
   e. Ground-fault protective devices.
   f. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Provide adequate time margins between device characteristics such that selective operation is achieved.
6. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. All three phase branch circuits with overcurrent protective device ratings greater than or equal to 30 amps.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. The calculations shall include the ac fault-current decay from induction motors. The calculations shall also account for the fault-current DC decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Low-voltage switchgear.
3. Motor-control centers.

H. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. Use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
9. Maximum demands from service meters.
10. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
11. Motor horsepower and NEMA MG 1 code letter designation.
12. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
13. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

   a. Special load considerations, including starting inrush currents and frequent starting and stopping.
   b. Time-current-characteristic curves of devices indicated to be coordinated.
   c. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
d. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.

e. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.5 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.

2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.

3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573
SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

   a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.
2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.
1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

PART 2 - PRODUCTS

2.1 SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate mandatory features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."
F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
5. Working distance.
6. Incident energy.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."
2. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.
   1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
   2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors shall be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond three to five cycles.

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
   1. When the circuit breaker is in a separate enclosure.
   2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

J. Label all panels with hazard ratings and required PPE per calculations in accordance with NFPA 70E and NEC.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
   2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Electrical Survey Data: Gather and tabulate the following input data to support study.
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
5. Motor horsepower and NEMA MG 1 code letter designation.
6. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.4 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 260574
SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
3. System smoke detectors.
8. Addressable interface device.

1.2 ACTION SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified, fire-alarm technician; Level IV minimum.
   c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
   a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
   b. Show field wiring required for HVAC unit shutdown on alarm.
   c. Locate detectors according to manufacturer's written recommendations.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Field quality-control reports.
C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
      b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
      c. Complete wiring diagrams showing connections between all devices and equipment.
      d. Riser diagram.
      e. Record copy of site-specific software.
      f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
         1) Equipment tested.
         2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

g. Manufacturer's required maintenance related to system warranty requirements.
h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Carbon monoxide detectors.
6. Automatic sprinkler system water flow.
7. Fire-extinguishing system operation.
8. Fire standpipe system.
9. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Activate preaction system.
9. Recall elevators to primary or alternate recall floors.
10. Activate elevator power shunt trip.
11. Activate emergency lighting control.
13. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:
1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Gamewell - FCI by Honeywell.

B. General Requirements for Fire-Alarm Control Unit:
1. Where existing systems are present, such systems shall be expanded, upgraded, or replaced with systems by the same manufacturer compatible with existing addressable devices to remain.
2. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
3. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
4. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class D.
E. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

   1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

2. Gamewell - FCI by Honeywell.


1. Dual-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Gamewell - FCI by Honeywell.
2. Gentex Corporation.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
c. Multiple levels of detection sensitivity for each sensor.
d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
   1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
   2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      a. Primary status.
      b. Device type.
      c. Present average value.
      d. Present sensitivity selected.
      e. Sensor range (normal, dirty, etc.).
   3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
   4. Each sensor shall have multiple levels of detection sensitivity.
   5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.
   1. Mounting: Adapter plate for outlet box mounting.
   2. Testable by introducing test carbon monoxide into the sensing cell.
   3. Detector shall provide alarm contacts and trouble contacts.
   4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
   5. Comply with UL 2075.
   6. Locate, mount, and wire according to manufacturer's written instructions.
   7. Provide means for addressable connection to fire-alarm system.
   8. Test button simulates an alarm condition.
2.7 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Gamewell - FCI by Honeywell.
2. Gentex Corporation.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

2. System Sensor.

B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Chimes: Vibrating type.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.

E. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
1. Mounting: Wall- or ceiling-mounted as indicated.
2. Flashing shall be in a temporal pattern, synchronized with other units.

2.9 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
   1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
   2. Wall-Mounted Units: Flush mounted unless otherwise indicated.

B. Material and Finish: Match door hardware.

2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
   1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

A. General:
   1. Include address-setting means on the module.
   2. Store an internal identifying code for control panel use to identify the module type.
   3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.
   1. Allow the control panel to switch the relay contacts on command.
   2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:
   1. Operate notification devices.
   2. Operate solenoids for use in sprinkler service.
2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
C. Equipment Mounting: Install fire-alarm control unit on finished floor.

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

E. Manual Fire-Alarm Boxes:
   1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
   3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

K. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed, in cable trays or J-hooks for tidy installation.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel in unfinished spaces, painted to match the surface to which it is mounted in finished spaces.
3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
10. Supervisory connections at fire-extinguisher locations.

3.4 IDENTIFICATION

A. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Perform the following tests and inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.


3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11
PREBID MEETING ATTENDANCE RECORD

PROJECT TITLE:  Lottes Health Sciences Library – 1st floor Phase One Renovation

PROJECT NUMBER:  CP200671

DATE:  4-3-20

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<td>(573) 875-0260</td>
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<td><a href="mailto:estimating@questec.us">estimating@questec.us</a></td>
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<tr>
<td>River City Construction</td>
<td>Joe Seymour, Jason Brown</td>
<td>6640 American Setter Drive</td>
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<td>573-657-7380</td>
<td></td>
<td><a href="mailto:jseymour@rccllc.com">jseymour@rccllc.com</a></td>
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<td>Schneider Electric of Jefferson City LLC</td>
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<td>Jefferson City, MISSOURI 65101</td>
<td>5736364101</td>
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<tr>
<td>Sircal Contracting, Inc.</td>
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<td>573-893-5509</td>
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<td>Y</td>
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<tr>
<td>Zodiac Inc.</td>
<td>Jimmy Talari</td>
<td>7305 Marietta Ave.</td>
<td>St. Louis, MO 63143</td>
<td>636-536-0330</td>
<td>636-536-2224 (fax)</td>
<td><a href="mailto:jimmy@zodinc.com">jimmy@zodinc.com</a></td>
<td>Y</td>
</tr>
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<td>Name</td>
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<td>Phone</td>
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<td>Harold G. Butzer</td>
<td>Curtis Dittmer</td>
<td>573-636-4115</td>
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<tr>
<td>E and K of Kansas City</td>
<td>Kevin Fox</td>
<td>816-765-4700</td>
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